The American Journal of Surgery

EDITED BY THURSTON SCOTT WELTON, M.D., F.A.C.S.

January 1941

FIFTIETH ANNIVERSARY

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A STATEMENT

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• In expressing appreciation for the co-operation and support of the profession during the past critical year, we are glad to renew assurances for the future.

• We, in the United States, have long led the world in the production of sutures and our resources far exceed domestic requirements. Ability to expand our facilities has been demonstrated through a year of extremely heavy demands from our own hospitals and government as well as from nations abroad. These demands have been met without upward revision of prices or departure from established standards.

• We, therefore, face the future confident of our ability to meet the requirements of our people.

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NOTE: In agreement with the new U. S. P. nomenclature, catgut products formerly known as Plain, 10-day, 20-day, and 40-day, are now designated as

Plain – type A **Medium chromic – type C**

Mild chromic – type B **Extra chromic – type D**

THERE HAS BEEN NO CHANGE IN THE PRODUCTS THEMSELVES

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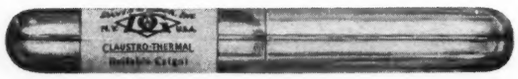

POSSESSES all the qualities essential to proper function and is adaptable to all conditions and technics. The tubes may be boiled or autoclaved for asepticization of their outer surface or treated germicidally.

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1285	Extra " —type D	54″	4-0 to 4

Package of 12 tubes of a kind $3.60

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1445	Medium " —type C	54″	4-0 to 4
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(Twelve tubes to a box)

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550	None	2 x 60″	4-0 to 0	$3.60
953	⅜-circle	20″	000, 00, 0	3.00
954	Half-curved	20″	000, 00, 0	3.00
852	None	40″	8-0, 6-0, 4-0 to 0	1.80

On reels, unsterilized
(Ten reels to a box)

				NET, PER DOZ. BOXES
50	None	190″	0000	$10.50
			000	11.64
			00	12.60
			0	14.40

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In tubes, sterilized
(Twelve tubes to a box)

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855	None	20″	1, 2, 3	1.80

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(Ten reels to a box)

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55	None	190″	1	$17.40
			2	20.16
			3	22.80

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50344	Half-circle	28″	5-0	4.20
50245	None	54″	5-0	3.60
40341	Straight	28″	4-0	3.60
40344	Half-circle	28″	4-0	4.20
40245	None	54″	4-0	3.60

THERMO-FLEX (*non-boilable*)

50541	Straight	28″	5-0	$3.60
50544	Half-circle	28″	5-0	4.20
50445	None	54″	5-0	3.60
40541	Straight	28″	4-0	3.60
40544	Half-circle	28″	4-0	4.20
40445	None	54″	4-0	3.60

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NO.	LENGTH	SIZES	DOZEN
A40	40″	8-0, 6-0, 4-0 to 4	$1.80
A120	2 x 60″	8-0, 6-0, 4-0 to 4	3.60

Packages of 12 tubes of a kind and size

Unabsorbable Sutures

NO.	MATERIAL	LENGTH	SIZES
350	Celluloid-linen	60″	000, 00, 0
360	Horsehair	6 x 28″	00
390	White silkworm gut	6 x 14″	00, 0, 1
400	Black silkworm gut	6 x 14″	00, 0, 1
450	White twisted silk	60″	000 to 3
460	Black twisted silk	60″	000 to 2
480	White braided silk	60″	00, 0, 2, 4

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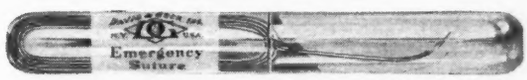
Emergency Kit Sutures

THREADED on half-curved or ⅜-circle eyed needles with cutting edges for skin, muscle, or tendon. Heat sterilized in glass tubes which may be either boiled or submersed in any active germicidal solution to asepticize their outer surface.



WITH HALF-CURVED NEEDLES

NO.	MATERIAL	LENGTH *in excess of*	SIZES
904	Plain—type A catgut	18″	00 to 3
914	Mild chromic—type B	18″	00 to 3
924	Medium chromic—type C	18″	00 to 3
954	Kal-dermic	20″	000, 00, 0
964	Horsehair	2 x 28″	00
974	White silkworm gut	2 x 14″	00, 0
984	White twisted silk	20″	000, 0, 2
986	Anacap silk	20″	000, 0, 2
900	Assorted: Catgut, Silk, and Kal dermic		

WITH ⅜-CIRCLE NEEDLES

903	Plain—type A catgut	18″	00 to 2
923	Medium chromic—type C	18″	00 to 2
953	Kal-dermic	20″	000, 00, 0
963	Horsehair	2 x 28″	00
973	White silkworm gut	2 x 14″	0
983	White twisted silk	20″	000, 0, 2
985	Anacap silk	20″	000, 0, 2
930	Assorted: Catgut, Silk, and Kal-dermic		

Packages of 12 tubes of a kind $3.00

Other D & G Sutures

IN ADDITION to the foregoing a wide variety of suture-and-needle combinations is available for intestinal, thyroid, tonsil, eye, harelip, cleft palate, plastic, nerve, artery, obstetrical, circumcision, ureteral, renal and dental surgery. A complete list of sizes, lengths, needle combinations, etc. will be supplied on request.

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Its development was the outcome of exhaustive studies which led to two important discoveries — (1) a method for producing catgut strands in these small diameters (0000 and 00000) with adequate strength for general use; (2) a treatment insuring gradual absorption and prolonged retention.

The compatibility of this new material with the tissues, its ease of handling and other physiologic and mechanical advantages have been demonstrated by extensive clinical use in a wide range of surgical procedures. Reports of experimental studies and clinical findings will be sent on request.

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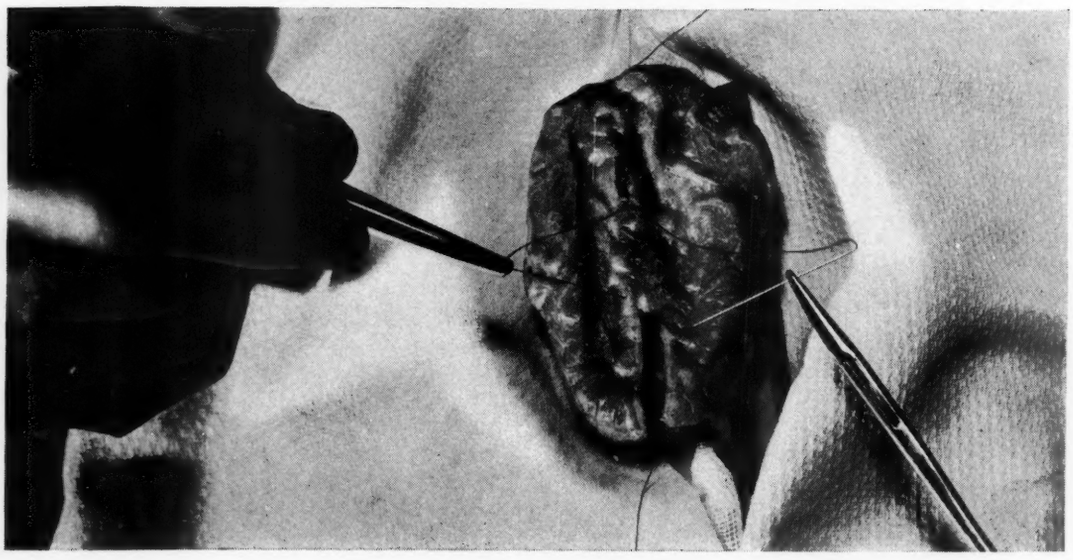

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THE POSTOPERATIVE ROAD to recovery is frequently an uphill grade, beset with the pitfalls of gas pains, distention, ileus, and urinary retention. More and more surgeons are finding in Prostigmin the helping hand that aids the patient through a smoother convalescence. Routine use of Prostigmin Methylsulfate 1:4000 prevents postoperative distention and urinary retention by maintaining the tone of intestinal and bladder musculature. The recommended dosage schedule consists of an intramuscular injection of 1 cc (1 ampul) of the 1:4000 solution immediately after operation, followed by 5 similar 1-cc injections at 2-hour intervals. Additional injections may be given if necessary; by effects from the use of Prostigmin in therapeutic doses are conspicuously absent.

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Hoffmann-La Roche, Inc.

LIKE most people who are known today without reserve as Americans, the antecedents of Hoffmann-La Roche were European. Many years ago, before the turn of the century, a young Swiss wholesale druggist decided to produce some of the pharmaceutical chemicals he sold, and so Mr. F. Hoffmann engaged the services of a very young Swiss chemist, Emil Barell. Mr. Hoffmann had faith in his young chemist's ideas and soon the world-wide Roche organization was born.

The dream of expansion found realization in America in 1905. It was in that year that a Hoffmann-La Roche company was formed in the United States. Offices were secured in New York City, but it was not long before the lusty infant outgrew these original quarters and several moves were made until Roche had its own building on Cliff Street, New York. When the first World War shut off European supplies, the manufacturing of Roche specialties in New York was started. It was at this crucial time that the managerial reins were placed in the capable hands of Elmer H. Bobst, an energetic young man whose outstanding record of achievement with the company had obviously destined him for higher places. From this point on, the remarkable growth of the organization, its rise to stardom among the first-ranking pharmaceutical specialty houses of the country, are to a great degree the results of Mr. Bobst's vision, his unbounded capacity for hard work and the loyal efforts of the men he gathered around him. In 1929, a beautiful, modern plant in Nutley, New Jersey, was built.

Roche research triumphs are internationally famous. Many of the Roche achievements are of particular interest to surgeons: Digalen, the first injectable preparation of the refined active glucosides of digitalis, which was announced in 1904; Dr. Sahli's injectable opium preparation, Pantopon, which came in 1909; and then Allonal, the non-narcotic hypnoanalgesic.

The company is now going through a period marked by notable research and production in the field of new synthetic remedies, such as Prostigmin, Syntropan, and vitamins in chemically pure form.

Prostigmin, at the time of its introduction, was regarded as a brilliant chemical and pharmacological achievement. It is probably the best available means for prevention or treatment of postoperative distention and also of urinary retention. Its use before radiographic procedures dispels obscuring gas shadows.

Among the outstanding accomplishments of Roche laboratories has been the production on a commercial scale of synthetic vitamins B_1, B_2, and C, plus their combination with other essential vitamins.

Chief among Roche multivitamin remedies is Vi-Penta Perles, the first small-size capsule to contain high potencies of the five principal vitamins, A, B_1, B_2, C, and D. Vi-Penta Drops soon followed the production of the Perles.

A palatable chocolate-malt combination, Cal-C-Tose, was also developed, containing the five essential vitamins, plus important minerals and other nutrients.

Various forms of thiamine hydrochloride, synthetic vitamin B_1, under the trade name of Berocca, have also been prepared with an eye to ease of administration and pharmaceutical elegance. Pure l-ascorbic acid, for use in wound healing and promotion of epithelial integrity, is available as Vitamin C 'Roche.'

The latest vitamin achievement of Roche laboratories is the synthesis of vitamin E, d,l-alpha-tocopherol. The product is now available as Ephynal Acetate.

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SINCE 1900, one of the greatest defense programs the world has ever witnessed has gradually gained momentum until today it stands as an exemplary tribute to modern science. Our "defense against disease" is studiously advancing through the allied efforts of medical science and industry. The growing interest and diversified application of *x*-ray by the medical profession suggests this brief outline on the development of *x*-ray by one of our pioneer manufacturers.

The Waite Division of the Picker *X*-Ray Corporation was founded in 1879 by Dr. Henry Waite. With the discovery of *x*-ray by Roentgen in 1895, Dr. Henry Waite directed his attention to the development of this most recent electrical phenomenon. At this junction Dr. Harry F. Waite joined forces with his father. By the year of 1900, the name of "Waite" was synonymous with *x*-ray development.

In 1904, a patent was granted to Dr. Harry F. Waite on the new "Solace Interrupterless" *x*-ray apparatus for fluoroscopy, radiography and therapy. The unit derived its name from that fact that it was designed initially for the U. S. "Solace," the first hospital ship to install *x*-ray equipment.

New and improved units of *x*-ray apparatus were invented and developed in rapid succession. Roentgenologists far and wide enthusiastically contributed their support to the development program. Through the co-operation and suggestions of Dr. Lewis Gregory Cole, the Cole Radiographic and Fluoroscopic Table was designed in 1912.

In 1914, Dr. Harry F. Waite, president of the Waite Manufacturing Division of the Picker *X*-Ray Corporation, built the first flexible superficial therapy tubestand. It was built according to the design of Dr. George Miller MacKee and was known the world over as the "MacKee Tubestand." The year, 1915, ushered in the U. S. Army Bedside Unit; a mobile *x*-ray apparatus famous for its adaptability to the hospital cot, cart or ward patients.

In 1920, a patent was issued on the first *shockproof* *x*-ray apparatus. The Waite Shockproof Dental *X*-Ray Unit contained an oil immersed *x*-ray tube and transformer in one receptacle and insured positive protection against shock or burn, from the high tension system or transformer. The first shockproof Vertical Fluoroscope was introduced in 1925.

Waite designed and built the first Three Phase Generator to be produced in this country in 1927. Eminent roentgenologists have acclaimed the manner in which this machine discloses detail hitherto unrevealed. In 1937, the Picker *X*-Ray Corporation formally presented to the roentgen ray profession the first completely self-contained diagnostic apparatus with a capacity of 200 milliamperes over and under the table. Today, the "Series 200" has been acclaimed the outstanding radiographic fluoroscopic *x*-ray combination for diagnostic purposes.

Again, in 1938, the Picker-Waite Organization introduced an entirely new self-contained, shockproof diagnostic *x*-ray unit in the low price range. This is known as the Waite "Century." Early in 1940 another new shockproof *x*-ray therapy unit made its appearance, known as the Picker-Waite "Zephyr."

The combined experience of Waite engineers and highly skilled craftsmen in the manufacture of fine *x*-ray equipment exclusively, is unequalled anywhere else in the world. They are specialists, schooled in the Picker-Waite tradition—Craftsmenship, a Creed; Accuracy, a Law.

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"The story of medicine enthralls the imagination by its infinite charm and arouses admiration for its victories in the battle against disease. The romance is so compelling that men cannot be unmoved by its splendor.

"Wonderful as the past has been, the last 50 years of medicine have witnessed more achievements of a miraculous character than the five preceding centuries."

Imbued with the ideals of the research workers of the past, a brilliant young Russian pharmacist came to New York in the early 1900's where he found wider opportunity for research and investigation. His acquaintance and contacts with Sir Arbuthnot Lane, who first used Russian mineral oil for the treatment of constipation, further stimulated his interest in finding some way to make this product more acceptable, palatable and effective.

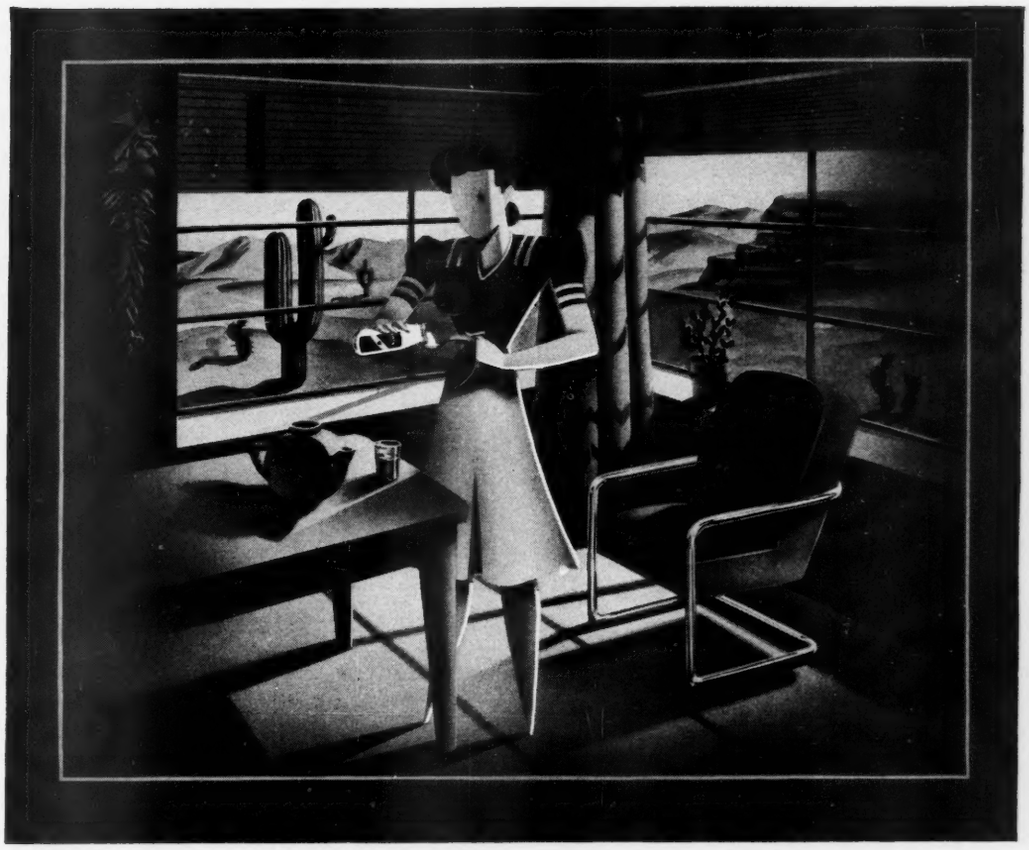
By diligent application of those arts which characterized his genius for happy combination of material and method, he eventually succeeded in producing an excellent emulsion of mineral oil, which later became known throughout the world as "Petrolagar" Brand Emulsion of Mineral Oil. This product found so ready an acceptance among the medical profession that it soon became apparent that a business organization was necessary. At this stage, activities were transferred to Los Angeles, where, in 1922, a business was incorporated, under the laws of the State of California, as Deshell Laboratories, Inc. In the same year, the first record of sales of Petrolagar Emulsion of Mineral Oil was made, through the regular drug channels.

The business grew rapidly and on November 15, 1922, a sales office and distribution depot was set up in Chicago and New York City, and a special detail staff was engaged in both of these centers. In 1923, the business was slightly reorganized and incorporated under the laws of the State of Delaware. In the following year, the California Charter was surrendered.

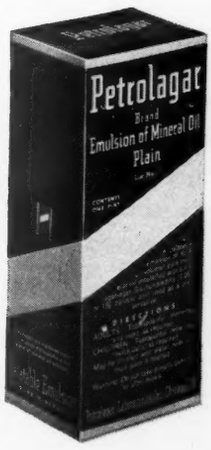
Considering the nature of the product, it was obviously an ethical one and, therefore, early in 1924 it was submitted to the Council on Pharmacy and Chemistry of the American Medical Association and accepted by them for listing in New and Non-Official Remedies.

Late in 1924, because of evident interest in the product abroad, it was found advisable to establish a business in Great Britain and, at that time, Deshell Laboratories, Ltd. was incorporated in the British Isles. The following year, in order to supply the demand outside this country it was found necessary to open branches in Canada and Australia, and, at the same time, distribution and sales were started in Mexico and South America. Then, late in 1925, the company started manufacturing in Great Britain, to supply the demand throughout Great Britain and Ireland as well as other markets throughout the British Empire. In 1929, manufacturing plants were set up in Paris and Milan, and arrangements for distribution were made in Switzerland, Germany and Austria.

From the foregoing, it can truthfully be said that the Petrolagar business is not without romance. In 1922 only a few thousand bottles were prescribed and the business was operated at a deficit. Today Petrolagar Laboratories, Inc. is a thriving business and the product is well and favorably known throughout the world. The company employs hundreds of persons in management, production and sales, exclusive of those in foreign countries.



Petrolagar*... *for the Treatment of Constipation*



● Petrolagar Plain, is a bland emulsion of high grade mineral oil. It helps to soften the feces and promotes the formation of an easily passed stool.

Petrolagar Plain helps maintain regular bowel movement without the use of harsh laxatives.

Suggested dosage:

Adults—Tablespoonful morning and night as required
Children—Teaspoonful once or twice daily as required

***Petrolagar—The trademark of Petrolagar Laboratories, Inc., brand emulsion of mineral oil . . . Liquid petrolatum 65 cc. emulsified with 0.4 gm. agar in menstruum to make 100 cc.**

Petrolagar Laboratories, Inc. • 8134 McCormick Boulevard • Chicago, Illinois

William R. Warner & Company, Inc.

THE great-grandfathers of today were infants when William Richard Warner, one day back in the late fifties, looked out of his laboratory window and watched the activities of a candy-maker across the street. It was no idle gazing, because a thought was forming in the mind of young Warner as he interestedly watched the sugar-coating applied to fruit and nut centers. Here was the candy-maker sweetening things for healthy people, while pharmacy was making bitter pills for the sick and suffering.

"Why not sugar-coated pills?"

And so the first sugar-coated pill was launched upon a sea of professional controversy, for there were still those who held firmly to the idea that medicine to be effective must be bitter and distasteful. But time and experience have placed their unqualified approval on the sugar-coated pill as a distinct contribution to the art of pharmacy in making medicines more palatable.

The close and intelligent observation and critical judgment of its founder laid down a course which William R. Warner & Co. Inc. was to follow in the years to come. Today, twenty branch laboratories abroad and sales representations in more than seventy other foreign countries are conclusive proof of how well Warner has lived up to its mission in promoting pharmaceutical progress and in earning the confidence and goodwill of physicians the world over.

To the guiding influences that have shaped its course and have contributed so unfailingly toward its upbuilding William R. Warner & Co. Inc. again dedicates itself. Products introduced under the Warner mark will always be of the best possible quality; they will be designed to meet an existing need; they will be a faithful interpretation of present-day medical progress in therapeutic effectiveness.

And now, recognizing the fact that research is the vital force controlling scientific and industrial progress, William R. Warner & Co. Inc. has established

THE WARNER INSTITUTE FOR THERAPEUTIC RESEARCH

with the express aim and purpose of pursuing fundamental research for the development and improvement of medicinal preparations and of measures of diagnosis and treatment. At this Institute men of acknowledged standing in their highly specialized professions are devoting themselves to the task of bringing within reach of medicine the "unknowns" that now lie beyond the horizon, of concentrating their efforts upon the discovery of better ways and safer drugs for the alleviation of human ills. Only devotion to this aim can sustain the research worker in his quest for the seemingly unattainable; and when his unremitting patience is rewarded and "new horizons" are reached, it will be the privilege of William R. Warner & Co. Inc. to make these results available to the medical profession.

In the chemical research laboratory, a quick eye and expert fingers measure the quantities of solutions in fractions of drops.

For JOHNNY SMITH

...as yet UNBORN

Counting colonies on the agar plates with a special apparatus, devised to give accuracy to the work of the bacteriologist in determining the potency of new antiseptics.

THE findings of a practical visionary, hovering over a bubbling flask in the laboratory, may bring the gift of health and longer life to generations yet unborn. Out of his labors may be forged the key that opens new doors to better, safer methods for treating disease and for preventing it. In the Warner Institute for Therapeutic Research, men and women, aided by the most modern precision equipment, are devoting themselves to the development of new remedial agents, to the improvement of known drugs, and — without commercial interest in view — to the enlargement of our scientific knowledge in health preservation.

OMNIS ORBIS
WARNER
ESTABLISHED 1856

113 West 18th Street, New York, N. Y. • 404 South 4th Street, St. Louis, Mo.

WILLIAM R. WARNER & CO. INC.

A world wide organization with laboratories and agencies in 75 foreign countries.

JOHN SKLAR, *Founder*

The Story of the HOUSE of SKLAR

LONG ISLAND CITY, NEW YORK

IN the year 1889, a twenty-two year old immigrant from Europe had his first view of the Statue of Liberty in New York Harbor. The name of the boy was John Sklar. His trade—the making of surgical instruments—was one familiar to Germany and England but almost in its infancy in America. For three years John Sklar worked in the plants of surgical goods' manufacturers in and around New York.

In 1892, the first page was written in the history of the J. Sklar Manufacturing Co. With the aid of a few hundred dollars frugally saved, together with some borrowed money, John Sklar set up his own business with the help of one assistant. That same assistant, today, forty-eight years later, is the superintendent of the company founded by his first and only employer.

The early days of the J. Sklar Manufacturing Company were built around a few patterns—mostly hand-forged instruments. But John Sklar was not only a skilled craftsman, he was a man of vision. He was the first one in the industry to forge a ratchet as part of a hemostat, instead of it being made of a separate piece of steel and welded.

For ten years the business of John Sklar grew slowly but soundly. Then, from the first days of the World War of 1914, progress was more rapid. The supply of surgical instruments from abroad was greatly curtailed. John Sklar was ready to meet this shortage. The company, well established and well manned with a competent staff of instrument makers, supplied vast amounts of instruments to the trade. In 1917, Sklar was making instruments for the Medical Department of the U. S. Army and Navy. Factory facilities were doubled. Throughout the plant the latest improved types of machinery were installed.

A few years later Mr. Sklar bought out the Steiner Mfg. Co., makers of a single model cylinder-type pattern of suction pump. This inaugurated the pump division of the Sklar business for which they are as famous today as for their stainless steel surgical instruments. The house of Sklar developed the rotary type of compressor, also the modern fire-proof and explosion-proof units now in universal use by physicians and hospitals.

In 1925, Sklar wrote another page in the history of the perfection of surgical instru-

ments. The Sklar Manufacturing Co. was the first to apply successfully chrome plating to instruments of this type. In less than five years chrome-plated instruments replaced nickel-plated.

With the advent of stainless steel, Sklar saw that here at last was the ideal metal for surgical instruments. But the stainless steel alloys available were not suitable for fine surgical instruments, so Sklar undertook several years of intensive research that finally resulted in a stainless steel alloy that was perfectly adapted for the making of the highest grade of surgical instruments, and their success in this research is now recognized throughout the profession. Today, the Sklar Company, in its new Long Island City plant, makes a greater number of patterns of stainless steel surgical instruments than have ever before been made anywhere in the world by a single manufacturer.

John Sklar died in 1930, but not before he had built a business established on the highest standards in the industry and had gathered around him a force of skilled craftsmen and business executives fully equipped to carry on the traditions of the founder.

John Sklar was succeeded in the presidency by Edward J. Sovatkin, who was reared and educated in Lowell, Massachusetts. He joined the company in 1902 as a combination apprentice-bookkeeper and, later, salesman. During the thirty-eight years that have followed, Mr. Sovatkin has devoted himself untiringly to the growth and development of the company. The two sons of John Sklar, Max H. Sklar and Albert S. Sklar, are respectively vice-president and treasurer of the company, and a grandson of the founder, Stanley Sovatkin, is now a member of the sales force.

Today the J. Sklar Manufacturing Company stands firmly upon the foundation of honesty, quality and progressive initiative laid down by John Sklar forty-eight years ago.

SKLAR INSTRUMENT MAKERS 1896

E. R. Squibb & Sons

AN IDEAL arising in a human need furnished the inspiration for the founding of E. R. Squibb & Sons. While serving in the U. S. Navy, Dr. Edward R. Squibb became conscious of the need for higher standards of purity and uniformity in drugs and for a more accurate knowledge of their potencies and uses.

His reports to the U. S. Naval Authority were of such urgency that Congress granted funds to establish a Government Laboratory in connection with the Naval Hospital at the Brooklyn Navy Yard, under Dr. Squibb's direction, to conduct necessary research with a view to improving and manufacturing the more important articles of the supply table of the Navy.

When his work increased to such proportions that objection developed to what was called "government competition with private enterprise," Dr. Squibb established a laboratory of his own.

In 1853, Dr. Squibb perfected his process for the manufacture of ether by continuous steam distillation. When ether purity had been brought to the standard set by Dr. Squibb, he turned to chloroform. Thereafter, he developed new processes for the manufacture of fluid extracts, assayed opium and invented and perfected the use of cocaine for use in operations.

Now the vision is forward to the prevention of disease. It was toward this end that the Squibb Institute for Medical Research, located at New Brunswick, New Jersey, was established. It is maintained as an organization separate and distinct from the business, manufacturing and research activities of E. R. Squibb & Sons. It is devoted to independent scientific investigations in the various fields of biology and experimental medicine. The Institute Building is equipped with the most modern type of apparatus.

Within the short period of two years the contributions of the Institute have been considerable. During the past year extensive experimental work has been published by Doctors Bergeim, Corwin, Greep, Lott, McKee, Rake and VanDyke on a new chemotherapeutic agent, Sulfathiazole, a compound which may prove to be the most useful of the sulfonamide derivatives yet employed. Chemotherapeutic studies are also being directed toward the therapy of bacterial, protozoal and viral infections.

In the Division of Organic Chemistry, the most immediate significant contribution was the discovery by Doctors Fernholz and Ansbacher that 2-methyl-1, 4-naphthoquinone (now marketed under the name Thyloquinone) possesses extraordinarily high vitamin K activity. In addition to studies on vitamin K, a number of fruitful investigations on plant sterols have been carried out and the synthesis of some of their degradation products has been accomplished.

During the past year the Pharmacological Division, under Dr. VanDyke, and in collaboration with Doctors Chow and Greep, has isolated for the first time in pure form two gonadotropic hormones from the anterior pituitary.

The Division of Microbiology has been actively engaged in studies on experimental measles and the virus has been isolated and cultivated in the developing chick embryo. The studies indicate the possibility of producing an effective vaccine for this disease. The virus of lymphogranuloma venereum has also been cultivated and a very highly purified preparation for use diagnostically has been made available.

Today the House of Squibb is making ready for an even wider range of service, and no one can foretell what developments may come out of the labor of science.

38 YEARS BEFORE

The American Journal of Surgery

WAS ESTABLISHED . . .

DR. SQUIBB MADE A SAFE ANESTHETIC ETHER

•

In 1853, Dr. Edward R. Squibb, having perfected his continuous steam distillation process, made ether safe for anesthesia. It is significant that so thorough was his work that to date (88 years later) his basic method is still used.

Squibb Ether was originally packaged in glass, later in tin containers. Constant research in the Squibb Laboratories eventually resulted in the development of a copper-lined container which definitely prevents the formation of aldehydes and peroxides. Squibb Ether is the only ether so packaged to prevent deterioration.

Squibb Ether is so pure, so effective and so uniform that it is used with confidence by surgeons and anesthetists in over 85% of American hospitals and in millions of cases every year.

•

For literature address the Anesthetic Division,
E.R.Squibb & Sons,745 Fifth Avenue,N.Y.

SQUIBB ETHER

MADE, TESTED AND PACKAGED ONLY IN THE SQUIBB LABORATORIES

Davis & Geck, Inc.

THE achievements possible through close cooperation between a producing organization and the profession it serves is demonstrated by the history of Davis & Geck, Inc. For over three decades this company has specialized in production of surgical sutures under the slogan, "This One Thing We Do."

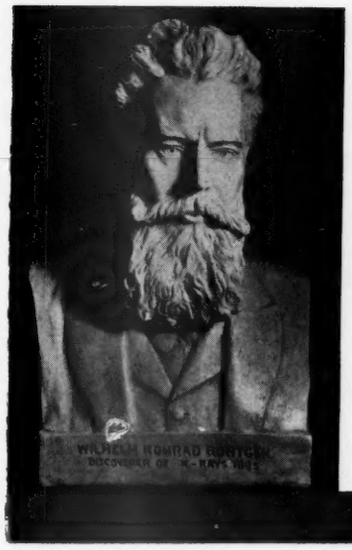
When the company was founded shortly after the turn of the century, commercially prepared sutures had by no means attained the full confidence of the profession. Many hospitals were still preparing their own sutures from imported materials and with results which reflected the meagre equipment and information at their disposal.

Realizing that a more complete understanding of suture behavior was an essential first step toward improvement and standardization, the young organization enlisted the cooperation of men active in surgery to collaborate with authorities on organic chemistry and bacteriology in a broad study of the problem.

Tissue reactions were studied and causes of irritation eliminated; positive methods of heat sterilization were developed; and more accurate chromicizing processes evolved.

These and other improvements which followed led to steadily increasing distribution and as the company grew the scope of its research program was broadened. Additions to facilities within the organization itself were supplemented by the establishment of fellowships and subsidy of independent studies. Dissemination of the information growing out of this work also became an important activity.

This integration of research with production and service with distribution—found in many phases of American industry—is accountable for much of our national progress. In the process of becoming the world's largest producer of surgical sutures, Davis & Geck has not only contributed to the advancement of surgery but, by making this country the center of supply of an essential product, has forged another link in our national security.



THE ROLE OF RADIOLOGY IN THE PAST HALF-CENTURY OF MEDICINE

"For one who can remember the birth of radiology, the story of the development of this science is a marvelous one. The light became visible like a dazzling meteor in the evening of the nineteenth century. It surrounded the morning of our own century with the rosy light of hope and promise. Like a glittering sun it shines resplendent on the working day of the twentieth century, revealing new fairways and fresh horizons in nearly every land in the world of science.

"In medicine, radiology has played the role of a pioneer *and a* creator *in the spheres of diagnostics and of therapy.*

"Its revolutionizing work in the domain of diagnostics *is that it has extended the physician's field of vision to include the interior of the living man. Roentgen diagnostic methods have increased diagnostic skill in almost every branch of the medical science, and in this way have contributed in a high degree to the reliability of our judgment of the indications of treatment and have thereby improved the results of treatment. I will merely remind my hearers that roentgen diagnostics have contributed most essentially to the magnificent progress made during the present century in the provinces of abdominal, thoracic, and cerebral surgery, and in orthopedics. As regards internal medicine, too, roentgen diagnostics have become an indispensable guiding star.*

"Also radiotherapy, *that is, Finsen-, Roentgen-, and Curie-therapy, has created an epoch in the history of medicine. By its destructive action on malignant tumors and dermatic fungi, by its power of hastening or causing a healing process in inflammatory conditions of various kinds, and by its readjustive action on certain disturbances in the functions of the endocrine glands and the hematopoietic organs, radiotherapy has become an indispensable weapon in the service of medicine."*

Extract from opening lecture by Dr. Gosta Forssell of Stockholm, Sweden, at Fifth International Congress of Radiology, held in Chicago, September 1937.

TO every one who has had opportunity to contribute in some way toward the many notable advances in x-ray science, these paragraphs must be both gratifying and inspiring. To us, as designers and manufacturers of x-ray and other electro-medical equipment during this truly great era in Medicine, they are significant of what the x-ray holds for the next half-century of progress. Thus we dedicate anew, our vast facilities for research and development, likewise the services of a world-wide field organization, in the sincere belief that the work ahead offers inspirations comparable with those of the past.

GENERAL ELECTRIC X-RAY CORPORATION

THE EVOLUTION OF X-RAY APPARATUS

FOR DIAGNOSIS: Far better than words, these "then and now" photographs illustrate the dramatic story of vast changes which have been made in the design of x-ray apparatus since Roentgen's announcement of his discovery in 1895. No photograph, however, can begin to tell the equally interesting story of the medical profession's ready acceptance of this diagnostic aid and its continued research so that mankind might fully enjoy the benefits of x-ray.

Early experiments revealed that the x-ray promised much, providing existing handicaps could be overcome. The handicaps consisted of such problems as excessively long exposures—ranging from a few minutes to an hour; the limitations imposed by cranky, erratic gas-filled tubes; and the lack of dependable, easy-to-control energizing apparatus.

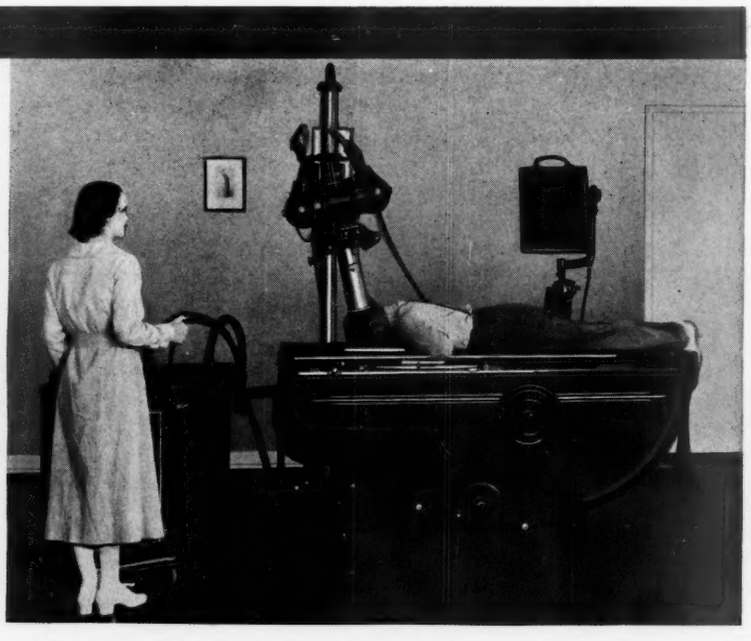
Gradually, larger capacity units were introduced, yet each required a tube of different design. Thus a laboratory had to be equipped with a tube of one type for damp days and another type for dry days. Under these conditions there could be no standardization of technics, no assurance of comparable results.

Order came out of chaos when, in 1912, Dr. W. D. Coolidge, of the General Electric Research Laboratory, announced the development of his hot-cathode x-ray tube. Radically new in principle, this tube was destined to revolutionize the x-ray art, for in the next quarter-century was written one of the most important chapters in the history of medicine.

Using the same fundamental principle, many other Coolidge tubes have since been developed —series upon series, more and more powerful, with ever-increasing refinements. Successively, they have opened new fields for medical research, widened the range of x-ray diagnosis, and contributed immeasurably to the notable progress in preventive medicine. One gets a true evaluation of their worth when one compares the capacity of an early type x-ray tube which required a 10-minute exposure for a chest plate, with that of today's high-powered Coolidge Rotating-Anode tube which produces an infinitely better chest film in 1/60th second.

For more than 40 years, working side by side with leading medical men, G-E's x-ray engineers have pioneered in making x-ray apparatus efficient and simple to operate so that radiographic results would consistently be of true diagnostic quality; have made equipment so flexible and so completely safe that many theoretical limitations to advanced technics were eliminated; so com-

Hand-driven static machine used for producing x-ray, circa 1896; exposure time for hand about 30 minutes.



A modern, shockproof, self-contained 500-ma. combination radiographic and fluoroscopic x-ray unit that is accurate and easy to operate.

GENERAL ELECTRIC
X-RAY CORPORATION

2012 JACKSON BLVD. CHICAGO, ILL., U. S. A.

pact that valuable floor space could be used for purposes other than housing the miniature substations often required for old-time generating units.

The parade of progress passes from the lowly hand-operated static machine to the powerful, streamlined, combination radiographic and fluoroscopic units of today. Step by step, research and experimental development in G-E's laboratories brought forth a succession of dependable, thoroughly-tested diagnostic apparatus that can be relied upon for continued satisfactory, efficient, and economical performance.

FOR RADIOTHERAPY: No less revolutionary have been the developments, from time to time, in equipment for radiotherapy. Some radiologists still living can no doubt recall the period when an x-ray treatment was administered with the simplest type of x-ray equipment as seen in the accompanying illustration.

"If," these early investigators reasoned, "the x-ray is, as we have observed, destructive to normal tissue, might it not be utilized for the destruction of abnormal tissue?" To those intuitive minds the world owes an eternal debt of gratitude, for thus was inspired the science of radiotherapy, which today offers, in some diseases, rays of hope and assurance where once was but despair.

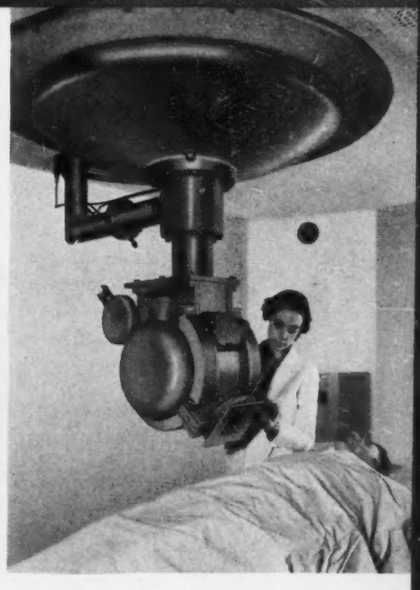
Since those first-used x-ray generators, operating at less than 100,000 volts, radiation therapy has come a long way. Persistent has been the demand for ever higher voltages, and these have been realized—gradually, however, with each stage of further development of the x-ray tube. Here, too, Dr. Coolidge's hot-cathode tube has played an important role, lending itself to these further and necessary developments to withstand the successively higher voltage ranges of 200,000, 300,000, 400,000, 800,000, and up to the most recently developed Coolidge tube for operation at 1,400,000 volts.

Equally important was G-E's introduction, some years ago, of an x-ray therapy unit featuring a radically new principle of design—complete oil-immersion of all high voltage parts, including the x-ray tube—to make the equipment much more compact and therefore easier to accommodate, with relatively low installation expense. Result: more institutions have found it economically feasible to adequately equip for x-ray therapy, thus making treatments conveniently available to a greater number of communities.

True, today's diagnostic and therapeutic x-ray equipment may seem to have approached the highest degree of perfection, but so it has seemed with each passing decade. And because medical scientists are ever seeking new and better means of attaining their objectives, G-E's facilities for research and developmental work will in all probability be challenged with future problems quite as critical as those of the past.

Simple indeed was the equipment used for x-ray treatment some forty years ago.

This modern method of x-ray treatment is with a G-E Shockproof Maximar Unit.



Patient being positioned for treatment under the million-volt Coolidge tube.

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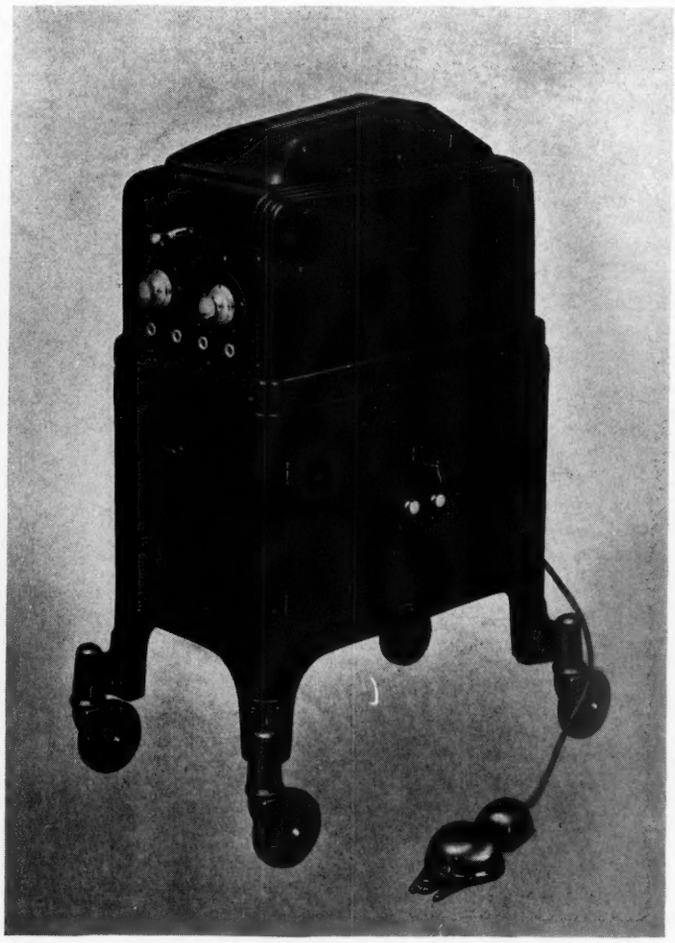
EFFICIENT ELECTROSURGERY

FOR electrosurgery's current wide range of indications, General Electric has developed four highly specialized units. The all-purpose Model "C" Unit illustrated here, for example, is widely favored by surgeons for the smooth, powerful cutting and coagulating currents which it delivers from two separate circuits under positive, convenient control. Of the dependable spark-gap oscillating circuit type, the Model "C" has an exclusive design of self-compensating gaps which maintain virtually identical spacing even throughout prolonged operation. Other features which have won hundreds of exacting buyers include ample reserve power—enough for cutting under water; simplified, refined regulation of intensity through variometer dial controls; availability of three constantly energized electrodes; and, of course, provision for easy detachment of all parts requiring sterilization. For literature on this reasonably priced instrument address Dept. E21.



The G-E Model "C" Unit for all electrosurgical procedures. It is shown here with the optional mobile cabinet — roomy, sturdy, and equipped with easy-rolling, rubber-tired casters.

Other G-E electromedical apparatus for the surgeon includes a complete line of efficient and dependable equipment and accessories for both treatment and diagnosis, to wit:

Short wave diathermy: G-E Model "B" Inductotherm, with or without electrosurgical feature.

Electropyrexia: G-E Model "S-1" Mobile Fever Cabinet.

Electrocoagulation and desiccation: G-E Model "A" Microsurgical Unit.

Galvanism: G-E Galvanic Generator.

Ultraviolet radiation: G-E Model "F" Ultraviolet Lamp, mobile or solarium type.

Infra-red radiation: G-E Model "C" Thermospectral Lamp.

Electrocardiography: G-E Model "B" Portable Electrocardiograph.

Auscultation: G-E Cardiofone.

Inquiries promptly answered; demonstrations at your convenience through 53 branch and regional offices throughout the United States and Canada.

GENERAL ELECTRIC X-RAY CORPORATION

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The Armour Laboratories

EVERY surgeon is a potential explorer and all clinicians may be considered research outposts in the vast territory comprising sufferings of the human race. It was the surgeons, for example, who discovered the importance of the thyroid gland and the clinicians who demonstrated the value of thyroid replacement therapy. To these pioneers the world owes much because no other gland is employed more extensively today than the thyroid, not merely to relieve the consequences of thyroid deficiencies, such as myxedema, but also as a potent and efficient drug for its pharmacodynamic action. The isolation of the thyroid hormone, Thyroxin, was accomplished by biochemists, and in the development of uniformly potent and dependable thyroid preparations The Armour Laboratories played a modest but important part. In brief, the details were worked out by chemists but the basic discovery belongs to the medical profession.

Ours is an age of extravagance. The modern operating room is a marvel of spotless conveniences but it is still the skill of the surgeon that determines the welfare of the patient. Modern drugs are made by up-to-date equipment and packed most attractively. All manufacturers who want to be in the lead must of necessity dress up their products, but here again it is the human element behind the drug that counts. The finest machinery in the world does not make good drugs without proper and efficient operators.

Back of the Armour pharmaceutical products of animal origin lies more than fifty years of sound, practical and scientific experience. The production men responsible for the quality of our products receive years of intensive chemical and biological training in our own laboratories before they enter the field of actual production. As a consequence, each man in the various production units is well qualified for his job, knows what he is doing, and takes particular pride in his work.

The Armour Laboratories enjoy the unique advantage of being an integral part of the Armour Packing Company, thus having access to one of the world's largest supplies of strictly fresh and United States Government inspected glandular and other raw materials, in addition to complete facilities for handling and processing these products.

The American Journal of Surgery rounds its fifty year mark in 1941. For half a century this publication has served the American surgeon as an efficient medium for recording progress in the branch of medicine dealing with operative procedures, healing of wounds and reestablishment of health.

The Armour Laboratories take this opportunity of wishing the American Surgeon and the American Journal of Surgery continued success, and a cordial invitation is extended to our medical friends to inspect our production and research facilities.

Abbott Laboratories

In 1885, a hardy young Vermonter graduated from the Medical School of the University of Michigan and entered practice in Chicago where, some three years later, he was to begin making pills, powders—and history. Wallace Calvin Abbott's total visible assets consisted of a healthy debt and a then-professionally-necessary frock coat.

Dr. Abbott was one of the first men in America to become interested in the early experiments of the great Belgian dosimetrist, Burggraeve. The revolutionary idea of employing only the *active principle* of a drug plant, instead of using the entire plant or a watery or alcoholic extract, appealed strongly to the logical mind of the young physician. He resolved to test the Burggraeve theory. Encountering difficulties in obtaining granules and other active principle preparations, then produced only in Europe, Dr. Abbott was literally forced into making his own remedies. The first Abbott advertisement—four lines in an Eastern medical journal—cost 25 cents and brought $8.00 worth of business; an indication of the growing interest in active principles. (Years later, when the house of Abbott was advertising regularly to every physician in America, the good Doctor used to express a wistful wish for "results like we used to get in the old days!")

The first Abbott "laboratory" was an annex to the family kitchen, where a young lady attended to bottling and labeling under Dr. Abbott's supervision. Stocks of the finished products were kept in a closet under the stairway of the Abbott home. As these quarters were outgrown, a frame house was rented and later purchased for manufacturing operations. In 1900, the business was incorporated as the Abbott Alkaloidal Company. Shortly after this, the rapidly growing company erected its first permanent structure—a three-story brick building, situated in the Ravenswood district on the North side of Chicago.

At the beginning of the World War in 1914, the firm name was changed to Abbott Laboratories since, in addition to the alkaloids or active principles, the firm's constant search for improved medicinals had already led to the manufacture of a variety of synthetic drugs. During the war, at the request of the United States Government, Abbott undertook the manufacture of many additional synthetics. The making of these complex organic chemicals greatly increased the need for space and, by 1925, necessitated moving from the residential district.

Thus, from a kitchen workshop Abbott Laboratories has developed into a stalwart institution occupying twenty-six acres in North Chicago, with manufacturing and sales branches throughout the world.

Yet now, as always, Abbott remains truly the servant of medicine; its spirit exemplified by its Fiftieth Anniversary theme: Changing Ideas—Changeless Ideals. The Abbott scientific staff is perhaps one of the largest, in proportion to the size of the institution, of any pharmaceutical house in the world. Here is to be found a group of highly competent chemists, pharmacists, pharmacologists and medical men whose collective background includes special training in a large number of the leading universities, research institutions and clinics located on both sides of the Atlantic. As Dr. Abbott surrounded himself with some of the most active medical and scientific minds which were available in his day, so Abbott Laboratories today continues to place its reliance upon untiring research and to acknowledge anew its indenture to the quests of science.

"The use of pentothal sodium has definitely established itself in the field of surgery as possessing many advantages over other anesthetic agents. Its use is safe, if administered by one who is capable of recognizing its danger signs and is qualified to deal with them in an intelligent manner should they arise."

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ABBOTT LABORATORIES • NORTH CHICAGO, ILLINOIS

LITERATURE ON REQUEST

PENTOTHAL SODIUM
(Sodium Ethyl [1-Methyl Butyl] Thiobarbiturate, Abbott)
ABBOTT

For Intravenous Anesthesia

Roche-Organon

Over the seas in Holland, about twenty odd years ago, a man of broad vision, directing one of the world's largest meat-packing houses, happened one day to have a talk with a scientist, the head of a leading Dutch university and one of the world's foremost endocrine research workers. As a result of the conversation, a scientific research laboratory became a part of the great packing concern. Thus N. V. Organon assumed an important position in the production of female sex and other important hormones.

This tremendous commercial development seems amazing, but it really is not strange when one considers that, always a step ahead of the manufacturing department, the original modest laboratory set-up in that packing house in Holland grew almost mushroom-like into a widely recognized scientific institute of endocrinology. In addition to gathering a distinguished staff of endocrinologists—chemists, physiologists, clinicians—at Oss, Holland, scientific collaboration was entered into with expert workers in many universities.

In America, only about three years ago, no really complete line of endocrine preparations was available from any one manufacturer, yet there was a genuine need for such a selection of high quality hormones obtainable from a single reliable source. It was entirely logical that a new company should be formed in this country for the manufacture and distribution of endocrine preparations, under the combined aegis of Hoffmann-La Roche and the Organon Laboratories. Thus, Roche-Organon, Inc., came into being in 1938, and already its hormone products are synonymous in the minds of physicians with highest quality and complete dependability.

Roche-Organon has a three-fold objective as a producer of endocrine preparations for the medical profession: research, controlled manufacture, and service. Continuous, unremitting research in Roche-Organon laboratories at Roche Park has as its constant goal the development of pure hormonal preparations, synthetically derived whenever possible. Controlled manufacture of these research-fostered hormones assures their uniform purity and effectiveness. Finally, Roche-Organon aims to provide the best possible service to physicians, both in supplying their hormonal requirements and in affording complete up-to-date information on any endocrinological topic.

One of the most recently developed Roche-Organon products is Liquaemin, the first American-made heparin of high purity for clinical use. Heparin, as Liquaemin, is being used routinely by an increasing number of surgeons as a means of ensuring against postoperative thrombosis and embolism. Another Roche-Organon preparation of interest to surgeons is Pregnyl, chorionic gonadotropin, whose preoperative use in cases of cryptorchidism often facilitates surgical correction, sometimes even bringing about testicular descent without operation. Doca, synthetic desoxycorticosterone acetate, is useful in those surgical cases in which adrenal cortical therapy is indicated.

The Roche-Organon line of sex hormones, male and female, has no superior. It includes testosterone propionate under the trade name of Neo-Hombreol, an estrone type of female sex hormone (Menformon), and estradiol, both plain and benzoylated (Dimenformon and Dimenformon Benzoate). These are available in various dosage forms: ampuls, tablets, and ointments (for percutaneous administration) in sealed, accurate-dosage capsules which are known as Dosules.

3-PHASE LEADERSHIP . . .

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As the pioneer in supplying ready-to-use Parenteral Solutions, Baxter Laboratories offer:

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The wide acceptance and popularity of these fundamental Baxter units give striking evidence of the flexibility and soundness of the basic principle of the Vacoliter.

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HOSPITAL SUPPLY CORPORATION

Eli Lilly and Company

In 1876, Colonel Eli Lilly, a skilled pharmacist and a veteran of the Civil War, opened a laboratory in Indianapolis for making prescription supplies. His capital was only about thirteen hundred dollars but by prudent economy, rigid adherence to high standards, and indefatigable industry the enterprise prospered. For several decades the major part of the earnings were plowed back into the business so that the institution might grow without being in debt or subject to the control of those who might not sympathize with its ethical aims. This policy has ever been maintained and the company is still owned and controlled by those who find their greatest satisfaction in the associations and activities involved in the manufacture of ethical, medical products.

Approximately twenty-two hundred medical products bear the Lilly Label. These include complete lines of standard pharmaceuticals and biologicals for use under the direction of physicians. They are sold by the drug trade throughout this country and in many foreign countries.

The principal offices and laboratories of the company in Indianapolis occupy twenty-eight major buildings. Scores of departments are quartered in these buildings, some of which are complete laboratories or factories in themselves.

It has been the policy of Eli Lilly and Company to increase the facilities for control work and original investigation as rapidly as the earnings of the company would permit.

Early at the turn of the century the staff included specialists in chemistry, pharmacognosy, and pharmacology, and plans were being made for work in the biological field. By 1910, the scientific control work and the research activities had grown so that they required a specially designed new building which was opened for use in 1911.

In 1922, the Insulin Committee of the University of Toronto accorded the Lilly Research Laboratories the privilege of co-operating in the production of a pure, stable form of insulin. As a result, the first insulin commercially available in the United States was marketed as Iletin (Insulin, Lilly).

About five years later the Harvard University Committee on Pernicious Anemia selected these laboratories to co-operate in the production of a therapeutic preparation of the liver fraction efficient in the treatment of pernicious anemia.

Co-operation with Dr. G. H. Whipple and his associates of the medical department of the University of Rochester led to the production of a therapeutic form of liver extract containing the fraction effective in the treatment of secondary anemia. Thus within a brief period the Lilly Research Laboratories had the unique honor of having co-operated with the original investigators in the development of three epoch-making medical discoveries whose authors received the Nobel prize.

In 1926, these exceptional facilities and advantageous connections with sources of supply enabled Eli Lilly and Company to be the first American manufacturers to make ephedrine available in adequate quantities in forms for therapeutic use.

The growing co-operation of the Lilly research staff with investigators in universities and clinics again made large facilities necessary. New laboratories were completed in 1934 and enlarged in 1940.

Research is conducted through the year in the Indianapolis laboratories and at the biological plant near by. Clinical investigations are carried on in laboratories maintained in a large hospital and also in hospitals in other cities.

Experience

adds the master touch in the preparation of fine medicinal agents. Only with experience can manufacturing procedures be so perfected that the ultimate in drug and biological purity is approached. The excellence of Lilly Products is a result of long years of well-directed effort and a desire to market nothing but the best.

Vitamin K Therapy with

PROKLOT

(2-methyl-1,4-naphthoquinone, Lilly)

'Proklot' is administered to prevent or treat hemorrhage in individuals with hypoprothrombinemia. Lowered prothrombin value should be suspected when hemorrhage occurs in association with such conditions as obstructive jaundice, biliary fistula, intestinal obstruction, or chronic diarrhea. Hemorrhagic disease in the newborn may be a manifestation of vitamin K deficiency.

Tablets 'Proklot' containing 1 mg. and 2 mg. are supplied in bottles of 40 and 500.

ELI LILLY AND COMPANY

Principal Offices and Laboratories, Indianapolis, Indiana, U. S. A.

Parke, Davis & Company

PARKE, DAVIS & COMPANY of Detroit, Michigan, are the world's largest makers of pharmaceutical and biological products. The Company's home offices and research and manufacturing laboratories occupy six city blocks, comprising sixteen acres, on the Detroit Riverfront, adjacent to the Detroit-Walkerville ferry, which connects the City of Detroit with the Province of Ontario, Canada. In addition, a beautiful farm of 700 acres, known as Parkedale and located near Rochester, Michigan, about thirty miles from Detroit, is utilized for the production of antitoxins, serums and vaccines, and for the cultivation of medicinal plants.

From the very beginning, back in 1866, Parke, Davis & Company has engaged in research work with the object of making available to pharmacists and physicians, medical preparations of the highest degree of accuracy.

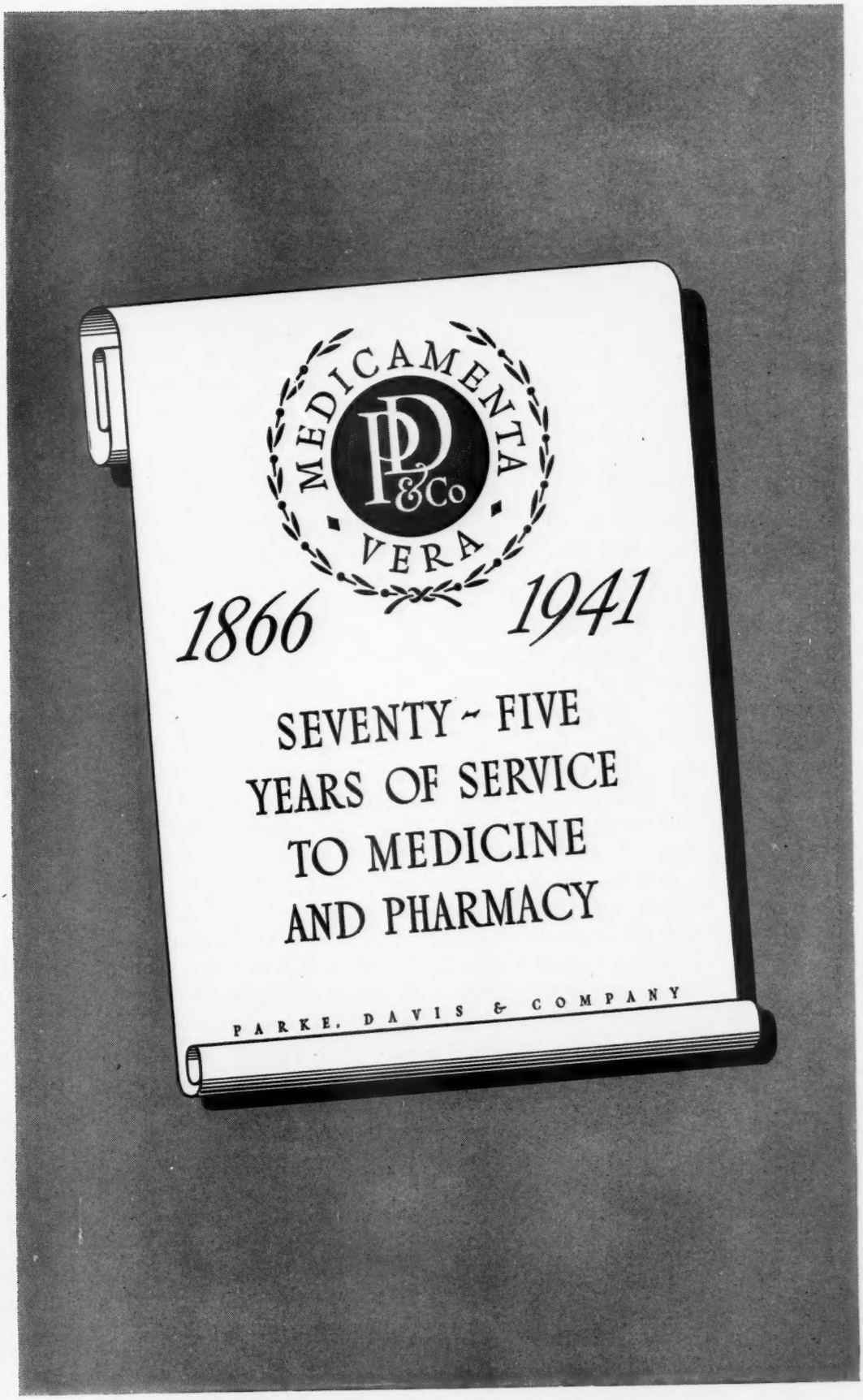
In the early 1870's, pharmaceutical progress meant the discovery of new vegetable drugs. Energetic—and expensive—explorations gave to the medical profession such valuable and widely used drugs as Cascara and Coca. Then, in 1879, came one of Parke-Davis's greatest contributions to pharmacy and medicine—the introduction of standardization to pharmaceutical manufacture. Desiccated Thyroid Gland, the first endocrine product supplied by the Company, was introduced in 1893. One year later, Parke-Davis established the first commercial biological laboratory in the United States. And throughout these early years, the fundamental Parke-Davis policy—precision in pharmaceutical manufacture—was crystallizing.

Since the turn of the century, progress of the Company has continued apace. An aggressive program of research has been zealously pursued, marked by the introduction of such important medicinal products as Adrenalin, Ventriculin, Theelin, Dilantin Sodium, Pitocin, Pitressin, Mapharsen, Antuitrin-S, Meningococcus Antitoxin, Eschatin and many others. Diversified research activities cover the major phases of medical treatment, including the endocrine, biological, vitamin, and chemotherapeutic, and new discoveries are carefully evaluated through the Company's extensive facilities for clinical investigation.

With progressive achievement along scientific lines has come a steady expansion in business. Manufacturing operations in Detroit have been constantly enlarged; eight foreign laboratories have been added, one after another, to care for the Parke-Davis business which now reaches every corner of the globe.

In 1931, to provide a more complete service to physicians and pharmacists, the Company entered the surgical dressing field through its acquisition of the Bay Company, the world's third largest organization of its kind.

Through the use of full-pages in leading national magazines Parke, Davis & Company are carrying on an advertising program that has atracted wide attention. As might be expected, their advertising is unique, ethical, distinctive. They make no direct attempt to sell their products to the public by means of this publicity. In a sincere effort to render a valuable service to the medical profession, they are running a striking series of messages based on the "See Your Doctor" theme, and physicians throughout the country are constantly experiencing evidences of the results of this broad educational program.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1866
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SEVENTY ~ FIVE
YEARS OF SERVICE
TO MEDICINE
AND PHARMACY
PARKE, DAVIS & COMPANY

Winthrop Chemical Company, Inc.

THAT the American Journal of Surgery has reached the golden age of fifty is conclusive evidence that its pages have been reflecting the progress of medicine and surgery. Everywhere medical science has advanced with such rapidity that those who witness history in the making are sometimes dazzled.

There were many gaps in the resources available to physicians and surgeons five decades back. Behring had just treated the first cases of diphtheria with antitoxin, and Koch was introducing tuberculin. Roentgen had not discovered the rays which supplement clinical acumen. Still in the offing were also radium, lumbar puncture, infiltration and spinal anesthesia.

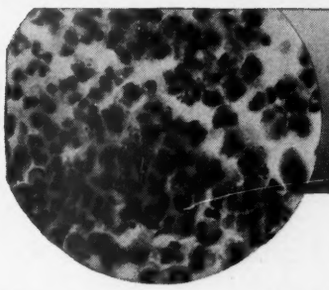
The pharmaceutical industry also has reached a high level of development in the interim. This was possible primarily through synthetic chemistry, which gave birth to many discoveries that contributed to the advancement of medicine. The term "synthesis" had not a lively significance to physicians in 1890, although a flourishing dye business had resulted from Perkin's discovery of artificial aniline, oddly enough, in his quest for synthetic quinine. However, there were in use a few synthetic pharmaceuticals, most of which have survived, including salicylic acid (1860), chloral hydrate (1868), iodoform (1879), antipyrine (1883), sulfonal (1885), acetanilide, urethane, salol (1886), amylene hydrate, guaiacol, phenacetine (1887), aristol, formaldehyde and salophen (1890).

Within the intervening decades, creative chemistry has evolved a host of meritorious agents. How very useful Novocain is for infiltration, regional and spinal anesthesia. What a blessing anxious patients experience through "basal" anesthesia, a term not found in dictionaries until Avertin was introduced for the purpose. How well Evipal Soluble proves that intravenous anesthesia can be both safe and serviceable. Without risk of addiction, preoperative and postoperative restlessness is controllable with barbiturates—Veronal and Luminal being the sires of a large progeny. Depleted nutritive states are combated with additions of vitamins—produced through the magic of synthesis. Some inevitable accident of surgery is deprived of tragic consequences, e.g., parathyroid tetany through dihydrotachysterol. The diagnostic value of Roentgen rays is amplified by contrast media (Skiodan and Diodrast in excretion urography), or a "chemical trocar" (Salyrgan) is substituted for the surgeon's instrument to remove dropsical effusions.

Is creative pharmaceutical chemistry an efficient collaborator of medicine? Consider the conquests over infectious diseases! Modern chemotherapy started with Ehrlich, whose painstaking labors culminated in the synthesis of Salvarsan—after 606 creative trials. Synthetic antimalarials now combat the scourge of hot countries, and other chemical compounds are used for amebic dysentery, filariasis, schistosomiasis and granuloma inguinale. Finally, Domagk's epochal discovery of the specific domination of Prontosil over the streptococcic kingdom has reversed the hitherto hopeless prognosis of sepsis and meningitis, and has rescued from disaster innumerable victims of bacterial diseases curable by other sulfanilamide compounds.

If medicine's past is fascinating, its future holds promise of further achievement. Perhaps disease will finally surrender her innermost secrets before the onslaught of research. To the attainment of such an ideal, there is proffered the continued collaboration of a scientifically constituted unit of the pharmaceutical industry: Winthrop Chemical Company, Inc.

NEW ANTIGONOCOCCIC AGENT



No longer a secret!

It has been clearly demonstrated that Sulfathiazole, the latest contribution to modern chemotherapy, is highly effective against the gonococcus as well as several other pathogenic organisms. In some hundreds of recorded cases, gonorrhea has yielded with remarkable promptness to this thiazole derivative of sulfanilamide. According to reports already published, Sulfathiazole conforms to rigid clinical standards for successful chemotherapy of gonococcic infection. In comparison with its pyridine analogue, it is less disturbing to the patient—having less tendency to cause serious nausea or vomiting—an advantageous feature in the treatment of both ambulatory and hospitalized patients.

Incidentally, Sulfathiazole is recognized also as an outstanding antipneumococcic and antistaphylococcic agent.

DOSAGE: *For adults,* two methods of dosage have been recommended:

(*a*) 1 Gm. (two 0.5 Gm. tablets) four times daily for five days.

(*b*) 1 Gm. (two 0.5 Gm. tablets) four times on the first day, and 0.5 Gm. (one tablet) four times daily for the next eight days.

The total average dosage by either method is 20 Gm. (forty 0.5 Gm. tablets).

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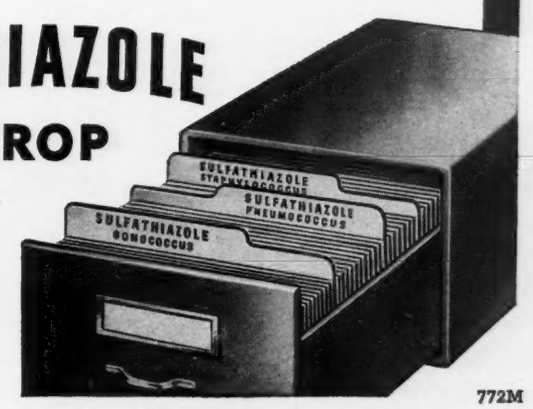

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D. Appleton-Century Company, Inc.

JUNE 1, 1933, marked the consolidation as D. Appleton-Century Company, Incorporated, of the distinguished book publishing houses of D. Appleton and Company, founded in 1825 and The Century Company, founded in 1870.

The early decades of the nineteenth century witnessed the beginning of the organized advance of all Sciences and among the influences contributing thereto was the Appleton publication of many pioneer scientific works, including Darwin's "Origin of Species" and Spencer's "Education" and "First Principles." The year, 1852, saw the publication of the first medical book on the Appleton list: "A Treatise of the Diseases of the Chest" by John A. Swett. In 1866 came Austin Flint's "Physiology," in 1869 Niemeyer's "Practice of Medicine," and in 1871 Billroth's "Surgical Pathology." Many other works succeeded each other throughout the remaining years of the nineteenth century, the quality of the Appleton publications being evidenced by mention of only two outstanding works: Sir William Osler's "Practice of Medicine" and L. Emmett Holt's "Diseases of Infancy and Childhood."

Coming into the twentieth century the House continued its progressive policy of sensing well in advance the trend of scientific thought. Lewellys F. Barker's "Clinical Diagnosis," Hiss and Zinsser's "Bacteriology," Billings' "Focal Infection," Elsner's "Prognosis," Forchheimer's "Therapeutics of Internal Diseases," and Kelly's "Gynecology" were among the Appleton texts which made history in their day.

Today, the Appleton-Century list of medical and surgical works significantly witnesses to the firm's distinguished history. Great sets cover all phases of medical science; single volumes represent the latest complete synthesis of their subjects. Classic works that through constant revision have been kept fully abreast of the times include Holt's "Diseases of Infancy and Childhood" (Eleventh Edition by L. Emmett Holt, Jr., and Austin McIntosh); Osler's "Principles and Practice of Medicine" (Thirteenth Edition by Henry A. Christian); Jordan's "Histology" (Eighth Edition); Zinsser and Bayne-Jones' "Bacteriology" (Eighth Edition); Rosenau's "Preventive Medicine and Hygiene" (Sixth Edition); Keyes and Ferguson's "Urology" (Sixth Edition); Yater's "Fundamentals of Internal Medicine" (First Edition, revised); Cole and Elman's "Textbook of General Surgery" (Second Edition, revised); Barton and Yater's "Symptom Diagnosis" (Third Edition); and many more too numerous to mention. The sets of current interest are "The Practitioners Library of Medicine and Surgery," thirteen volumes with a 1940 supplement, edited by George Blumer; "Therapeutics of Internal Diseases," four volumes, now in process of publication, edited by George Blumer; the new "Abdominal Operations," two volumes, by Rodney Maingot; the "Postgraduate Surgery," six volumes, edited by Rodney Maingot.

January, 1941, and the immediately following months will bring the publication by D. Appleton-Century Company of such works as the five volume "Surgical Therapeutics" edited by Frederic W. Bancroft, the Williams "Obstetrics" new eighth edition by Henricus J. Stander; the new third edition of Kolmer and Boerner's "Approved Laboratory Technic;" the new Practitioners Library "1940 Supplement," and further volumes in the Blumer "Therapeutics of Internal Diseases."

As its emblem states, "Inter Folia Fructus" is the continuing motto of this one-hundred and sixteen year old house.

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George P. Pilling & Son Co.

While the George P. Pilling & Son Co. of Philadelphia, was established over one hundred twenty-five years ago, we limit this discussion to the last fifty years during which the company has been identified with many important developments in the surgical instrument field.

Early in this period came an important improvement in the stethoscope—the Bowles diaphragm chest piece. This antedated all similar efforts and it is the prototype of the modern disc-type stethoscope chest piece. More recently this chest piece has been combined with a bell chest piece in one instrument, known as the Sprague-Bowles.

Many methods were used in making various types of speculums, but Pilling & Co. developed a new process, producing what is known as wrought metal speculums. These were lighter, stronger and smoother, whereas the older types were heavy and bulkier, and were difficult to keep surgically clean.

Early in this century, the life insurance examiners demanded a more portable and sturdier blood pressure apparatus than the mercury instrument. The appearance of the Faught Pilling Aneroid Blood Pressure Apparatus was the answer.

One of the greatest developments in medicine, in modern times, is that of bronchoscopy. With the co-operation of Dr. Chevalier Jackson, Pilling & Son Co. developed an armamentarium for this work that includes the greatest offering of models and sizes available. The offerings of this particular branch alone now fill a catalogue of over one hundred pages. As much of this work is done in emergencies, a special delivery service is maintained to make shipments of orders received after hours, on Sundays and holidays.

Increase in interest in new treatments for the surgery of tuberculosis has resulted in the creation of special thoracic instruments for this branch, and Pilling & Co. have now a most complete line of these instruments, mostly of their own make and many of them original designs by leading American and foreign specialists. This development is noteworthy, also, because of the close inter-relationship between bronchoscopy and thoroscopy, and obvious advantages result to the profession by having both types of instruments produced under the same roof.

During the first World War, this firm co-operated very closely with the Medical Department of the Army and Navy in the matter of supplying the necessary instruments. Now these close relations are renewed and great effort is now being put forth to aid the Medical Department.

The past decade in the history of the George P. Pilling & Son Co. has taken up the manufacture of many new lines, in some cases making instruments not heretofore made in this country, to cite as examples, the Bruening otoscope, Schiotz tonometer and nasal forceps to fit the universal hand.

About fifteen years ago, to assure the profession that it was getting Pilling-made instruments without possibility of substitution, the Pilling Company opened a most complete Retail Department.

At about the same time, a surgical pump department was started. In this the Pilling-made, electrically driven, suction and pressure pumps of both piston and rotary type were made.

It is the desire of George P. Pilling & Son Co. to promote the manufacture of instruments in this country and to prepare, in every way, to make America independent of foreign sources of supply for surgical instruments.

Johnson & Johnson

IN 1886, when medicine and surgery were just beginning their most brilliant chapter, Johnson & Johnson came into existence. Since then, this company has not only witnessed the marvelous changes in these arts, but has held a conspicuous part in their advancement. Just prior to 1866, a number of important events occurred. Out of the researches of Pasteur, bacteriology was born. Then came Lister, from whose great conception modern surgery was evolved. Johnson & Johnson devised a system of dressings that fulfilled the demand of the new Listerian system. This marked the real beginning of antiseptic surgery in this country.

Through the years, many famous Johnson & Johnson products that once stood for the "last word" in supplies have come and gone: Zonweiss, chest protectors, Pryor's Gauze, Styptic Leaves, Mosquitoons, Camphocine and Plaster's Baer's Membrane.

Following is a brief historical outline of other landmarks, Johnson & Johnson developments that pioneered the modern and efficient systems we know today:

In 1886, the Johnson Brothers formed a co-partnership and began manufacturing adhesive plasters. Their "plant" consisted of one small building. In 1887, the manufacture of sterile surgical catgut was begun. New methods of making and packaging absorbent cotton were devised. These improvements made absorbent cotton important in surgery and in the arts. Linton Moist Dressings and Antiseptic Ligatures were introduced.

A pamphlet, "Modern Methods of Antiseptic Wound Treatment," was published by Johnson & Johnson in 1888. This was the first textbook in the new era of surgery.

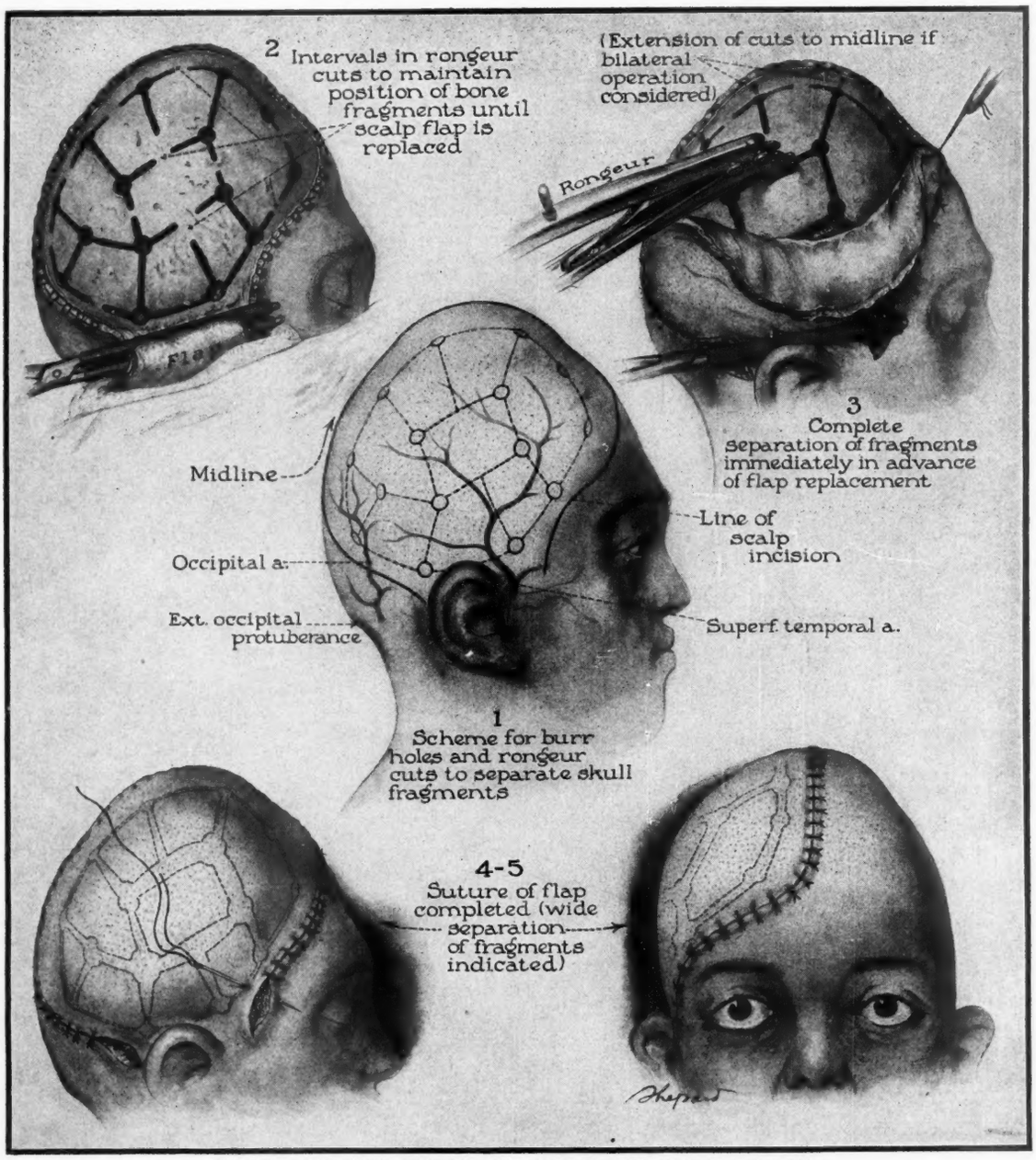
In 1890, cotton and gauze dressings were sterilized by dry heat. Six years later complete first aid systems and emergency dressings were introduced. In 1899, Johnson & Johnson, in co-operation with several leading American surgeons, developed and introduced the Zinc Oxide type of adhesive plaster.

The following year, the Red Cross Cotton Mill was built. Johnson & Johnson also introduced the cultivation of belladonna in the United States. These early efforts later helped prevent a shortage of belladonna during the World War, and during that war the resources of Johnson & Johnson helped make possible an adequate supply of surgical dressings.

In 1921, the Johnson Suture Corporation, a subsidiary, was established. In its laboratory adjoining the Chicago stockyards, sheep intestines are transformed into surgical catgut under modern aseptic methods. The new Johnson & Johnson factory, later enlarged, was built in Chicago in 1934. With other additions through the years, this brings the American plants and laboratories to nearly fifty acres of floor space. In 1940, an additional factory for the manufacture of sanitary napkins was completed.

The construction of a new Johnson Suture Corporation plant is now in progress in Chicago. A complete, new, modern Ligature Laboratory for the preparation and sterilization of sutures has been constructed in North Brunswick Township, New Jersey.

With the passing of the years, the institution still remains "Johnson & Johnson." Robert W. Johnson, Chairman of the Board, has attained to the active management. Under his control and guidance, the services and facilities of Johnson & Johnson have been amplified until they now coverthe world; and Johnson & Johnson products have retained the confidence of the professions they serve.

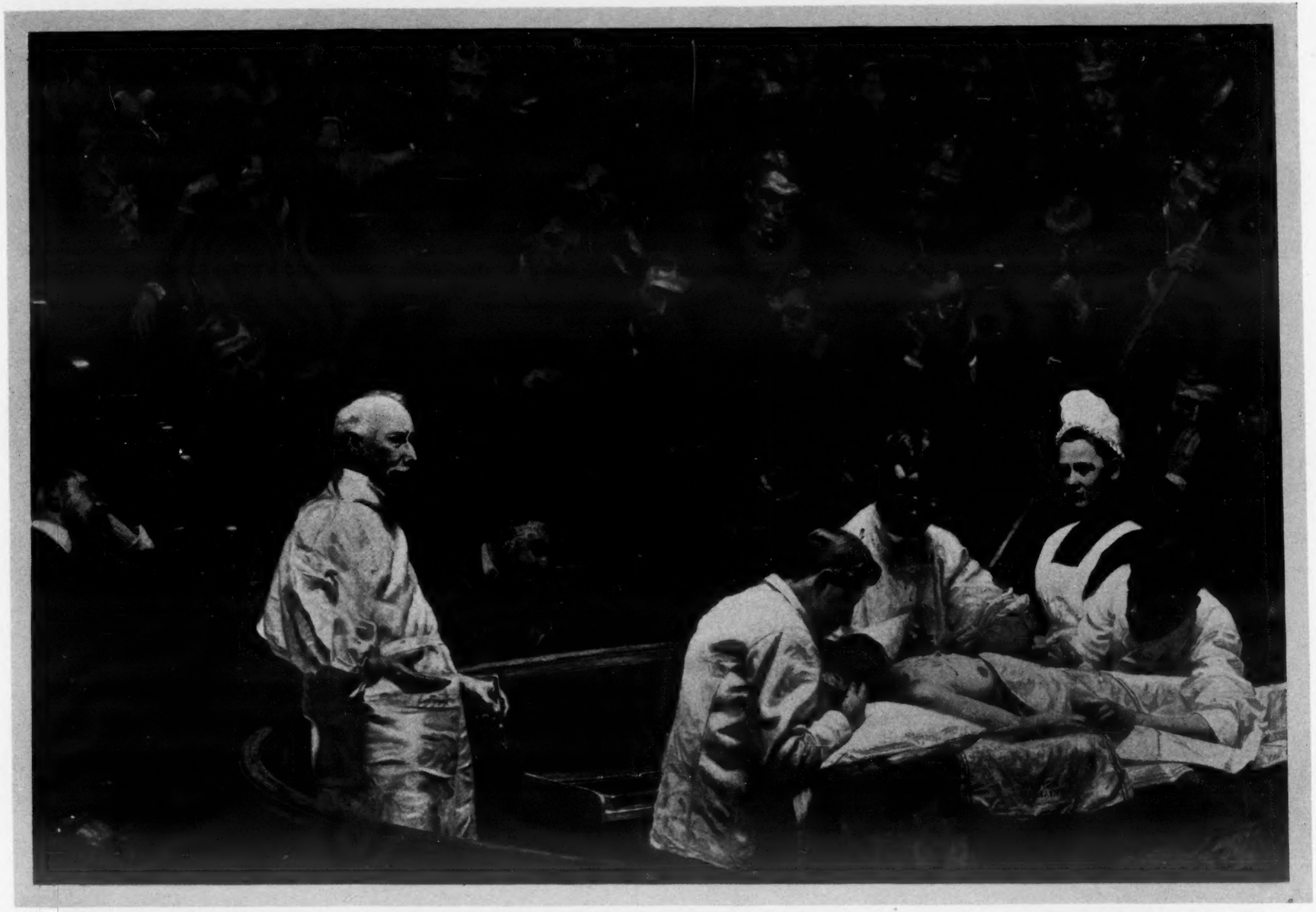

2 Intervals in rongeur cuts to maintain position of bone fragments until scalp flap is replaced
(Extension of cuts to midline if bilateral operation considered)
Rongeur
3
Complete separation of fragments immediately in advance of flap replacement
Midline
Occipital a.
Ext. occipital protuberance
Line of scalp incision
Superf. temporal a.
1
Scheme for burr holes and rongeur cuts to separate skull fragments
4-5
Suture of flap completed (wide separation of fragments indicated)
Shepard

OPERATIVE PROCEDURE—PLATE NO. 113—COPYRIGHT 1941, JOHNSON & JOHNSON

Oxycephaly (King)

The Ethicon Suture series on Operative Procedure starts its eleventh year with this issue. Johnson & Johnson has received many splendid comments on this series from surgeons, and hopes that in 1941 the drawings will again be found interesting and useful. "Operative Procedure," Eighth Edition, just published, contains all drawings to date. Your request to the Ligature Division will bring a complimentary copy.

SUTURE MAKERS
Johnson & Johnson
NEW BRUNSWICK, N. J. CHICAGO, ILL.
SINCE 1887



by Thomas Eakins (1844–1916)

THE AGNEW CLINIC—1889
Courtesy of the University of Pennsylvania

For explanation see page 40.

The American Journal of Surgery

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A PRACTICAL JOURNAL BUILT ON MERIT

NEW SERIES VOL. LI JANUARY, 1941 NUMBER ONE

Editorials

FIFTIETH BIRTHDAY

THE American Journal of Surgery is fifty years old, having been first published in 1891 in Kansas City, Missouri. At that time it was called the American Journal of Surgery and Gynecology. Fourteen years later the name was changed to its present title. It has had an uninterrupted existence to date. For years it consisted of thirty pages of reading matter. Then, about twenty years ago, it grew into a publication of twelve hundred text pages a year. Ten years later this was doubled, and many special issues have run over three hundred fifty pages of reading matter. Today, the American Journal of Surgery is a fixture in the American surgical scene. It goes to every State in the Union, its Territories and to every civilized country in the world (except at the present time, due to war restrictions).

The contributors to this Birthday Number tell of the birth and growth of the various surgical specialities and surgical societies. Other contributors treat of subjects closely allied with surgery. In this way one gets a good perspective of the progress of surgery in this country during the past half century.

Imagine the state of this country, the profession of medicine, and surgery fifty years ago. Benjamin Harrison was President; the population of the country was 62,622,250; there were 104,805 doctors of medicine. Electricity for illuminating purposes was still a dream of the future. In cities the well-to-do lighted their houses with gas; others used oil lamps. Highways connecting towns and cities were dirt roads that became well nigh impassable at certain times of the year. There were few hospitals. Only the poor, objects of charity, went to hospitals for surgical operations or medical care. People lived for the most part in houses and not in two and one-half room apartments. When an operation was necessary it was done at the patient's home, the surgeon and his assistants going there with their stew-pots, pans and sterile goods. No self-respecting woman would dream of going to a hospital to give birth to her baby. To be sent to a hospital after serious consultation in the case of obstetrics usually meant a cesarean was in order, an operation with an appalling mortality at that time. Most of the surgical specialities were either in the embryo stage or not thought of. When this Journal was born, Halstead, at Johns Hopkins, had rubber gloves made for his operating-room nurse whom he later married. These gloves were designed to prevent a dermatitis of her hands caused by the technic in vogue at that time. Bloodgood reasoned that if rubber gloves were a comfort to the nurse then why not have the comfort extended to the surgeons and their assistants. All this

is told in J. M. T. Finney's "A Surgeon's Life," a delightful autobiography just published.

In the early nineties certain physicians began to confine their work exclusively to surgery. But their numbers were few. Only a small percentage of medical graduates thought an internship was either necessary or valuable. They jumped from the graduating exercises into practice. But as the century died all this changed. A new era had begun. Hospital construction grew apace and an internship became essential. Some States required a year's internship in order to get a medical degree. Later on, as the specialities became firmly established, the resident system began.

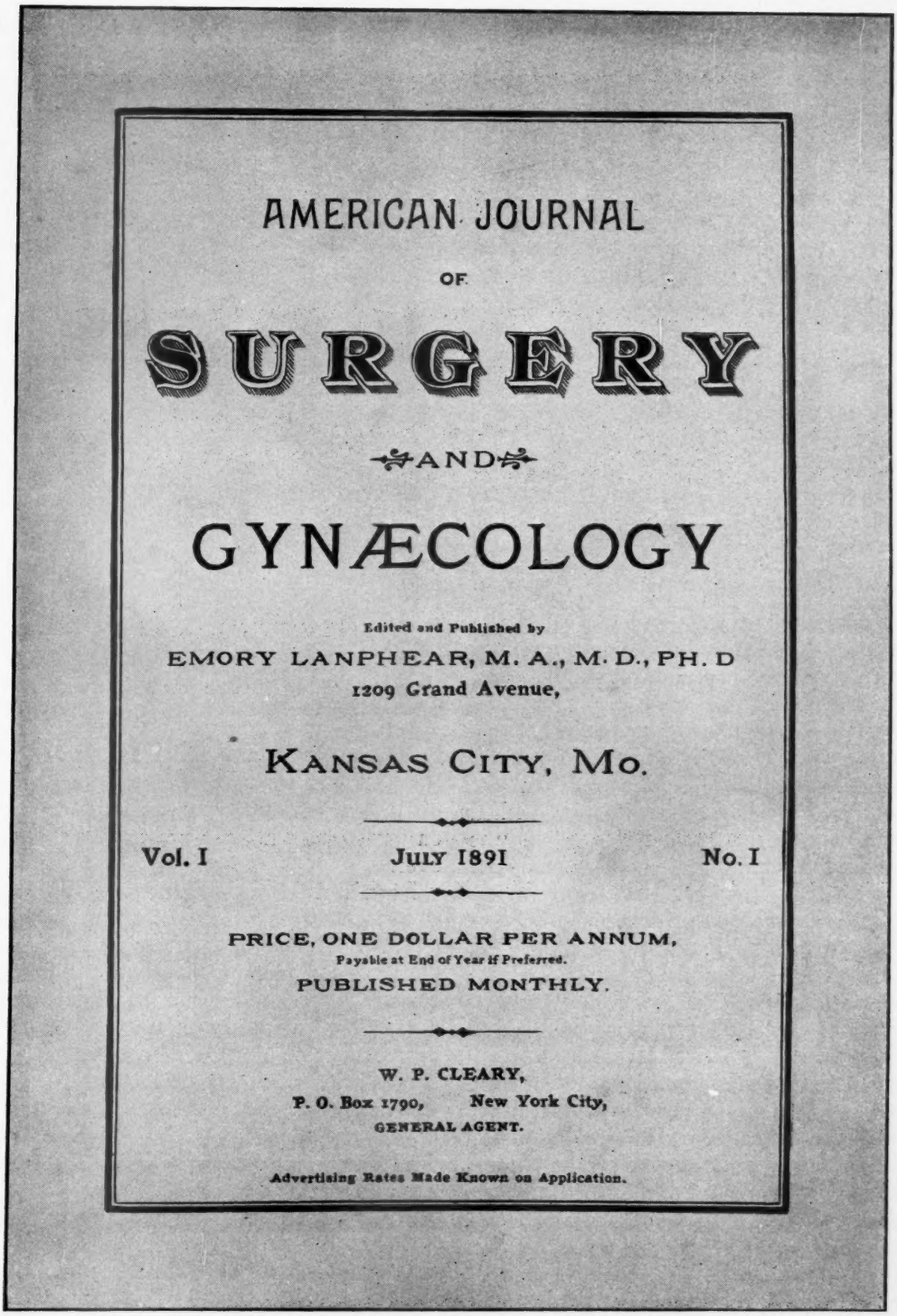
At one time a man could awaken in the morning and without more ado call himself a specialist. Preliminary training was not essential. This, too, has changed. The American College of Surgeons and the various American Boards have done an excellent and praiseworthy work in this connection. The American Medical Association, also, deserves no end of credit for the part it has played in medical education, the standardization of hospitals and their approval of hospitals for intern and resident training.

In 1891, medical schools peppered the land. Many of them were either fly-by-night affairs that sprang up like mushrooms and often as quickly expired, or they were proprietary schools conducted mainly for financial gain. The faculty of such schools judged the success of the school and its teaching by the cash dividends at the end of the year. After Abraham Flexner published his report and recommendations, this type of medical school folded up. Today, the approved Grade A medical schools, rather than making money, require large endowments to keep anywhere near solvent. It has been said that the medical college is the financial nightmare of the university.

In the early nineties the course of instruction leading to a medical degree covered but two years in the majority of schools. Later it was increased to three years. At the beginning of the present century the standard four year course began and some schools increased it to five years. Fifty years ago it was not unusual for a mere lad, not yet twenty-one years of age, to graduate from medical school. In the majority of states he could not receive his degree until he had complied with the law. We have a close friend, just reached the retiring age of sixty-five years, who had to wait a year before receiving his degree because when he was graduated he was just twenty years old. At the present time it may be that the pendulum has swung as far to the other side; for now by the time a student has completed his academic and medical education, served an internship and residency, and done some extra post-graduate work, he has reached his middle years.

Out of curiosity we went to a library and managed to get hold of some eastern medical school catalogues of the beginning nineties. We were curious to see what textbooks were recommended and required.

We learned that Flint had written three books: Practice of Medicine ($4.00), Clinical Medicine ($3.60) and Percussion and Ausculation ($11.40). Surgery was represented by such authors as Erichsen ($7.00), Bryant ($5.20) and Billroth ($4.00). Diseases of the Genitourinary System, by Keyes ($4.00), was popular, as was his Venereal Diseases. Sayre wrote Spinal Diseases and Spinal Curvature ($3.20). Lusk's Obstetrics ($4.00) was universally popular, while Gray's Anatomy ($4.80) competed with Quain's Anatomy which cost $9.60. Some of the other titles were: Diseases of Women, by Skene; Diseases of the Skin, by Tilbury Fox; Gould's or Quain's Medical Dictionary; Shepard's Chemistry; Klein's Elements of Histology; Huxley's Elementary Physiology or Foster's Physiology; H. C. Wood's Therapeutics and Materia Medica; Mann's Prescription Writing (most schools do not teach this subject today); Hamilton's Fractures and Dislocations and Delafield



The First Cover of the American Journal of Surgery

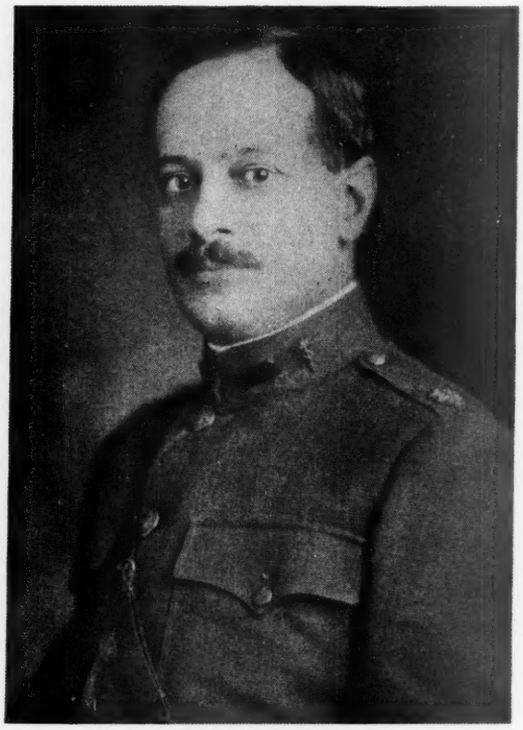
and Prudden's Pathological Anatomy. One catalogue stated that "Text-books may be obtained from the janitor, at the College."

EMORY LANPHEAR, M.D., PH.D.
Editor of The American Journal of Surgery, 1891–1905.

Many of the former textbooks were the bain of medical students. Huge tomes had to be carried about and great volumes had to be digested.

And so, during these long ago but peaceful times, away out in the then far west, Kansas City, The American Journal of Surgery was born. It was published monthly and the subscription price was "One dollar per annum—*Payable at the end of the year if preferred.*" Evidently, many took advantage of this generous offer but forgot to part with the dollar when due, for, somewhat later the subscription rate became fifty cents but that was "*payable strictly in advance.*" This price held for all "citizens of the United States outside of Kansas." For some unaccountable reason foreigners and the Kansans were charged one dollar. About 1893, the circulation had increased to 5,000 (we wonder how much of this was dead wood and unpaid) and the subscription rate went back to one dollar. In Volume V, the reader's attention was called to the fact that it was a "clean, bright, newsy paper full of interesting news and medical literature." In 1898, it became a weekly for a short time.

There have been three editors of the American Journal of Surgery since it was founded. The first editor was Emery



WALTER M. BRICKNER, M.D.
Editor of The American Journal of Surgery, 1905–1928.

Lanphear, M.A., M.D., PH.D., LL.D. He served from 1891 to 1905 when he was succeeded by Walter M. Brickner, M.D., who carried on until 1928 when the present editor took over.

Both Dr. Lanphear and Dr. Brickner were interesting personalities and men of parts. Lanphear was born in 1859 and received his medical degree at Missouri Medical College, St. Louis, in 1881. He did a good deal of postgraduate work in Chicago and New York. He was Professor of Operative Surgery, Kansas City Medical College, Professor of Surgery, St. Louis College of Physicians and Surgeons, and Professor of Surgical Gynecology and Clinical Surgery, Medical Department, National University of Arts and Sciences, St. Louis. These chairs he held at various times. He was president of the St. Louis Academy of Medicine, and also of the Tri-State Medical Society of Iowa, Illinois and Missouri. So, he must have been quite a doctor. He died

at the age of sixty on February 6, 1920, at Citrus Park, Florida.

In 1905, the ownership of the Journal changed hands. It came to New York and Walter M. Brickner became editor. On the occasion of the change in ownership and editorship Dr. Lanphear published the following "Valedictory" in the April, 1905, issue:

"If it be true that 'of two evils one should choose the less' certainly of two good things one should select the better. American Journal of Surgery and Gynecology has grown to such a remarkable degree that one man no longer can manage it. I have therefore submitted to the inevitable and resigned the editorship in order to devote my entire attention to my private practice. The Journal is removed to New York and placed under the management of Dr. Jos. MacDonald, Jr., who is well and favorably known to every surgeon and gynecologist of America by reason of his many years' success as a medical publisher. The editorship passes to Dr. Walter M. Brickner who has had much experience in that field of work. So—it may be predicted safely that the Journal is sure to be of greater value and importance under the new management than it has ever been under the old. To the many friends who for nearly twenty years have assisted me in making American Journal of Surgery and Gynecology one of the leading medical periodicals of the world I wish to express my sincere thanks; also earnestly to request them to aid the new management with the same encouragement and support they have so heartily given to me. To the thousands of readers in every part of the land I extend my hand in a most cordial Farewell!"

We republish this valedictory because the change marked another milestone in the life of the Journal. Under Dr. Brickner's guidance it became a new and different publication.

Dr. Walter Brickner was an unusual man. He was editor from 1905 until 1928. It was a great loss when he died in 1930, on which occasion Dr. Howard Lilienthal wrote in an editorial in the August, 1930, issue, in part as follows:

"A handsome, slender, bright-eyed youth, Walter Brickner appeared before the Examining Committee at Mount Sinai Hospital competing for a place on the House Staff. It was then that I first met him. I was assisting Dr. A. G. Gerster, Examiner in Surgery.

"The Phi Beta Kappa symbol gave promise of scholarship and brilliancy which was confirmed as soon as he began to speak. He easily won the honors of the examination. . . .

"With the skill and originality which brought success in Surgery, a fine technical quality set his writing at a high level and distinguished the character of his contributions to the literature. Especially in his work on the treatment of actinomycosis of the pelvic recesses and in his articles on subacromial bursitis there was a clearness of thought and expression which made reading easy and which forcefully carried his message. What more natural then that with such talent he should be attracted to the field of medical journalism and that finally he should achieve a prominent editorial position. For many years, under his management, the American Journal of Surgery developed and became more and more attractive to important contributors both here and abroad.

"The World War reached out and at last drew our country into its grip. To Captain Brickner, later Lieutenant Colonel, was given the responsibility of assembling the group of men who became the enlisted personnel of Base Hospital No. 3, also known as the Mount Sinai Hospital Unit. . . .

"Overseas Dr. Brickner, then a Major, rendered valuable and patriotic service both at the Base and in Evacuation Hospital No. 8 near the front. Through it all his exquisiste humor never failed while his personal care and tender sympathy gave last comfort to those whom his skill could not save.

"Back from the War Colonel Brickner, now once more a New York Surgeon, became active in military organizations and, for a time was Surgeon on the Staff of the Manhattan Chapter of the Military Order of the World War.

"He resumed his position at Mount Sinai Hospital and later became Chief Surgeon of the Hospital for Joint Diseases. Dr. Brickner was also honored by an appointment as Skeletal Surgeon to Morrisania Hospital.

"He was a Fellow of the New York Surgical Society and of the Academy of Medicine and was associated with other professional bodies.

"And now, at the height of his career, he is gone! All those who knew him grieve over the loss of a faithful friend and comrade while our profession will sorely miss an outstanding figure."

Dr. Brickner did an excellent piece of work and laid a firm foundation for future growth.

We took over the editorship in 1928. Then, we had a lot of ideas but only sufficient material for about one issue. For a long time it kept us awake nights wondering how we could get suitable material to meet the oncoming dead-line. Now, we keep awake for exactly the opposite reason —to keep from accepting too much material. However, we have no wish to recite all that has been done and the changes made in a little over a decade. Suffice it to name a few: The Journal was increased to 2,400 text pages a year. Changes were made in the advertising policy and the advertising curve has gone steadily upward during the past five years. Three textbooks were published serially. Then, monographs were introduced, complete in one issue. Special Numbers, most of them under a Guest Editor, appeared three or four times a year. Our friends have informed us that the monograph and special-number ideas have been copied by other publications. If this be true, we are flattered.

We have been asked on what basis we accept an article. Perhaps it is an editorial sixth sense. But if an article has a good practical point in diagnosis, treatment or technic, we believe it worthy of publication. Above all we want the Journal to be a helpful journal, a practical journal in that it will aid the man from the big surgical centers as well as the individual doing all the surgery in a small town. We favor papers short and to-the-point, and we judge the material on its merits and not on the name under the title. Evidently, this has been a good policy for the circulation has had a persistent, healthy growth. Many subscribers have been with us for many years. For instance, Dr. J. B. Lowman, of Johnstown, Pennsylvania, has been a subscriber for forty years.

During the past fifty years articles by nearly every surgeon of national reputation have appeared in our pages. Sometimes their articles have been "firsts." Our Associate Editorial Board are not just window dressers. We use them and often. We seek their counsel and advice. In the main, we send them articles that come to us for publication. We ask them to pass judgment on the worth and value of these articles, and we accept or reject an article upon the report received. We have yet to ask a favor of any member of our Editorial Board in vain. Their spirit and co-operation have been splendid.

Today, The American Journal of Surgery is a fixture, a part of American surgery. One day another editor will take our place; it may have other publishers, but it will never have one more generous and progressive than the present one; and we wonder what America, medical education, the practice of surgery and this Journal will be like when another fifty years have ended. We pray the world will be at peace, that men will truly be civilized, that medicine will be a profession of men known as good citizens and possessed of high ideals and dignity, and that what has been planted during times of travail will have flowered into something fine and permanent, and that our grandchildren and great-grandchildren will know the true meaning of contentment, freedom and peace on earth.

T. S. W.

A HALF CENTURY OF SURGICAL LITERATURE

EVENTS lived day by day are little impressive; it is like growing a wart. It is only when reviewed in retrospect that they become impressive. The books of the early days were individual efforts. Gross and Agnew were and are still monuments to their authors. Gross, who wrote the first books on pathology in the English language reflected this knowledge through his books on surgery. Agnew was the master clinician who it seemed had seen everything, of course everything that had been recognized within his day.

Systems by many authors were an invention of a later day. The editor selects a group of his colleagues who are assigned to discuss a given subject. The handicap lies in the fact that being nominated by his friend for a given task he accepts the assignment. Having no primary interest in writing, it is poorly done. He is in the position of a deacon when called on by the minister to lead in prayer. Being in profound thought of a horse trade he expects to put over the next day, he is startled and the prayer is apt to be sketchy and unconvincing because he is attempting to carry on two lines of thought at once.

Much more salutory are the many monographs written by one author. It is a subject in which he has a special interest and consequently receives his best efforts. These monographs usually contain all that is known about a subject, and then some, trusting the reader to locate what is likely to be useful to him. Recently a number of brief exceedingly practical books have appeared which tell the reader what he should know.

The notable advance in literature has taken place in the periodic literature. The Journal of the American Medical Association was once an anemic little sheet not the equal of many of our state journals. It is today the leading periodical in any language. It contains articles read at the national meetings, the news of the doings, in the various stages, why people are sued for malpractice and last but not least, each subscriber is sure to get his name in the journal some day—a complete necrology is given each week.

As a reaction a number of the worth while weeklies of long ago have been suspended. This was inevitable but unfortunate because many of the best articles were published in these journals and book files of them furnish many of our best references.

Among surgical journals the Annals remains with us, dignified as ever, containing only articles of high class, and for the most part practical. Notable addition to the Journal list is the Archives, a protege of the American Medical Association. The articles are primarily scientific and of primary interest to those engaged in research. Also notable is Surgery, Gynecology and Obstetrics, which is characterized by articles of worth. Noteworthy is the abstract department. This covers most of the worth while articles published in journals throughout the world.

Last but not least is the American Journal of Surgery. This is an eminently practical journal containing articles useful to every practicing surgeon, the friend in time of need. The articles are brief, to the point, and valuable to the practicing surgeon. It should be noted, too, that the American Journal of Surgery comes out in a new dress with this issue. Its cover is new and so also the general format. The type used for department headings has been changed to conform with that used on the cover and to make the Journal as attractive as possible.

ARTHUR E. HERTZLER

THURSTON SCOTT WELTON, M. D., F. A. C. S.
Editor, The American Journal of Surgery, 1928–

Our Editor

THURSTON SCOTT WELTON, M.D., F.A.C.S., Brooklyn, New York, is the Editor of The American Journal of Surgery, a post which he has held since 1928. He is also professor of clinical obstetrics and gynecology, Long Island College of Medicine, director of the Department of Obstetrics and Gynecology, Greenpoint Hospital, attending obstetrician and gynecologist to Long Island College Hospital and consulting gynecologist to Southside Hospital. In 1917, he held the office of president of the Brooklyn Medical Society, in 1926 he was the president of the Brooklyn Gynecological Society and in 1927 was elected president of the Medical Society of the County of Kings. He is a Fellow of the American College of Surgeons and of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons. Since 1930, Dr. Welton has been a Diplomate of the American Board of Obstetrics and Gynecology.

Associate Editors

Fernand de Gueldre

CARL BECK

CARL BECK, M.D., F.A.C.S., Chicago, Illinois, was born in Nilin, Bohemia, in 1864. He attended the Royal Gymnasium of Prag and was graduated from the Medical Faculty of Prag in 1889 after which he came to America. From 1891 to 1917, he was professor of surgery and surgical pathology at the College of Physicians and Surgeons, Illinois State University. He is one of the charter members and founders of the American College of Surgeons, an honorary member of the Academy of Rome, Italy, and a member of the Gesellschaft der Ärzte, in Vienna. Dr. Beck was the founder of two hospitals in Chicago, North Chicago and St. Anthony Hospitals, and was influential in the establishment of the system of exchange professors between the United States and Europe. In 1912, he was asked by the Nobel Committee to recommend a candidate for the Nobel Prize. Dr. Alexis Carrel, Dr. Beck's former assistant, was chosen. Dr. Beck has educated large numbers of assistants, several of whom now occupy important posts at different universities.

Clifford Norton

CLAUDE S. BECK

CLAUDE SCHAEFFER BECK, M.D., F.A.C.S., Cleveland, Ohio, received his degree in medicine at Johns Hopkins University in 1921. In 1923, he was the Arthur Tracy Cabot Research Fellow at Harvard Medical School and in 1924 the Crile Research Fellow at Western Reserve University. Since 1924 until today he has held the posts of assistant resident, resident, instructor, assistant professor and associate professor of surgery at Western Reserve University. Dr. Beck has carried out extensive studies for the development of cardiac surgery. He has introduced the concept of the compressed heart; he has demonstrated the extrinsic factors that cripple the heart, and he introduced the operation for revascularizing the heart by grafting tissues upon the heart. Dr. Beck was the first person to defibrillate the human ventricles. He has shown that cardiac contusion is not an uncommon injury to the heart, and has suggested reinforcement of the cardiac wall against rupture by placing grafts of pericardium upon the weakened wall of the heart.

Rios Studio

GEORGE R. BRIGHTON

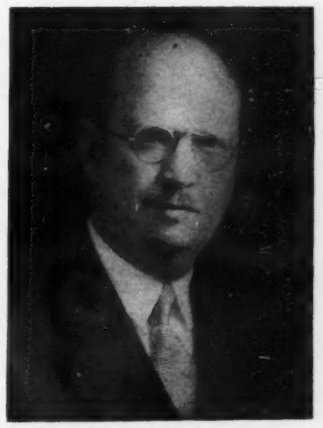
GEORGE RENFREW BRIGHTON, M.D., F.A.C.S., New York, New York, was born in Jersey City, New Jersey, in 1900. He is a graduate of Dwight Preparatory School and his degree in medicine was secured at the College of Physicians and Surgeons, Columbia University, in 1924. Dr. Brighton also studied at surgical clinics in Great Britain and on the continent. He served a surgical internship at Roosevelt Hospital and an ear, nose and throat internship at Bellevue Hospital. In 1925, he took a special course in peroral endoscopy under Dr. Chevalier Jackson. He is a Fellow of the New York Academy of Medicine, of the American College of Surgeons and of the American Academy of Ophthalmology and Otolaryngology. He is also a Diplomate of the American Board of Otolaryngology. He is now attending otolaryngologist to Presbyterian Hospital, Vanderbilt Clinic and Babies Hospital, consulting otolaryngologist to Roosevelt Hospital and assistant clinical professor of otolaryngology at the College of Physicians and Surgeons, Columbia University.

MEREDITH FAIRFAX CAMPBELL, M.D., F.A.C.S., New York, New York, was born at Lake Geneva, Wisconsin. He received his medical degree at Columbia University in 1919 and now specializes in urology. He is a Diplomate of the American Board of Urology, a member of the American College of Surgeons and of a number of well known medical and surgical organizations. In 1930, Dr. Campbell was chairman of the Section on Genito-Urinary Surgery of the New York Academy of Medicine; in 1939, he was vice-chairman of the Section on Urology of the American Medical Association. At present he is president of the American Urological Association and treasurer of the Society of the Alumni of Bellevue Hospital. Dr. Campbell is also professor of urology, New York University, associate visiting urologist to Bellevue Hospital, director of urology at Mountainside Hospital, Montclair, New Jersey, and consulting urologist to Memorial Hospital, Morristown, New Jersey. Dr. Campbell is the author of "Infection of the Kidney" and of "Pediatric Urology."

Underwood & Underwood

MEREDITH F. CAMPBELL

JAMES THOMAS CASE, M.D., F.A.C.S., Chicago, Illinois, was born in San Antonio, Texas, in 1882. He was graduated from the American Medical Missionary College which later merged with the University of Illinois College of Medicine. He received his Diploma of Medical Radiology and Electrology at Cambridge University, England, in 1920. At various times he was president of the American Roentgen Ray Society, American Radium Society and the American College of Radiology. During the World War he acted as Head of the *X*-ray Service of the American Expeditionary Forces. At present he is professor of roentgenology, Northwestern University Medical School, radiologist to Passavent, Highland Park and U.S. Marine Hospitals and on the surgical staffs of Grant and Swedish Covenant Hospitals. He is also consultant in radiology to Cook County Hospital. Dr. Case has always been interested in the correlation of surgical and radiological work, and has been interested especially in digestive disorders and in the treatment of cancer. He was the first in the United States to employ 200 kilovolt deep *x*-ray therapy.



JAMES T. CASE

ISIDORE COHN, M.D., F.A.C.S., New Orleans, Louisiana, specializes in surgery. He received his academic degree at Louisiana State University in 1903 and his degree in medicine from Tulane School of Medicine in 1907. He served on the faculty of Tulane University from 1909 to 1937 occupying the positions of clinical assistant, instructor in minor surgery and professor of clinical surgery in the Undergraduate School, and professor of surgery and director of the Department of Surgery in the Graduate School of Medicine. At the present time he is the professor of surgery and associate director of the Department of Surgery of the Graduate School of Medicine, Louisiana State University Medical Center. In 1935, Dr. Cohn was elected Chief of the Surgical Staff of Touro Infirmary to succeed Dr. Rudolph Matas who retired. He now acts as senior visiting surgeon to Charity hospital, senior consultant in surgery to Flint-Goodridge Hospital and director of medical service at the Episcopal Home.

ISIDORE COHN

Bradley L. Coley

BRADLEY LANCASTER COLEY, M.D., F.A.C.S., New York, New York, was graduated from Yale in 1915 and from the College of Physicians and Surgeons, Columbia University, in 1919. In 1925, Dr. Coley was president of the New York and New England Association of Railway Surgeons and in 1938 was secretary to the New York Surgical Society. At one time Dr. Coley was chosen as a member of the Commission for the Study of Crippled Children. He is also one of the founders of the American Board of Surgery and a Fellow of the American Surgical Association, American College of Surgeons, Southern Surgical Association, New York Surgical Society and Eastern Surgical Society. At present he is chief surgeon of the New York Central Railroad, attending surgeon to Memorial Hospital and the Hospital for Ruptured and Crippled, visiting surgeon to Lincoln Hospital and surgeon-in-chief to Mary McClellan Hospital, Cambridge, New York. Dr. Coley is the author of many monographs on hernia, bone tumors and other surgical subjects.

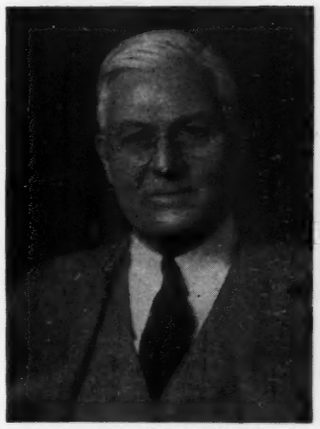
Kazanjian

Frederick A. Coller

FREDERICK AMASA COLLER, M.D., F.A.C.S., Ann Arbor, Michigan, was born in Brookings, South Dakota, in 1887. He received his academic degree at South Dakota State College in 1906 and was graduated from Harvard Medical School in 1912. During 1915 and 1916 he served with the Royal Army Medical Corps of the British Expeditionary Forces and from 1917 to 1919 was with the American Expeditionary Forces. His rank at the end of the war was that of Lieutenant Colonel. At present Dr. Coller is engaged in the practice of general surgery and is professor of surgery and chairman of the Department of Surgery at the University of Michigan and University Hospital.

Paul C. Colonna

PAUL C. COLONNA, M.D., F.A.C.S., Oklahoma City, Oklahoma, was born in Norfolk, Virginia, in 1892. He received his degree in medicine at Johns Hopkins Medical School. Dr. Colonna served general surgical internships at St. Elizabeth's Hospital, Richmond, Virginia, and at Memorial Hospital, New York City. He was associate orthopedic surgeon and chief of clinic to the Hospital for the Ruptured and Crippled, New York, from 1930 to 1937, and for one year was the assistant professor of clinical orthopedic surgery at the College of Physicians and Surgeons, Columbia University. At present he is professor of orthopedic surgery, University of Oklahoma School of Medicine, and director of the Department of Orthopedic Surgery at State University and Crippled Children's Hospital. Dr. Colonna is a member of a number of orthopedic associations and medical societies and is the author of numerous articles on orthopedic surgery, with particular reference to ununited fractures of the neck of the femur and congenital dislocation of the hip.



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GEORGE CRILE

GEORGE CRILE, M.D., F.A.C.S., Cleveland, Ohio, received his medical degree from Wooster University (now known as Western Reserve University) in 1888. He also studied in Vienna, London and Paris. Dr. Crile was the president of the American College of Surgeons in 1916 and chairman of the Board of Regents of that organization from 1917 to 1939. He is also one of the founders and directors of the Cleveland Clinic Foundation. At present he is surgeon to the Cleveland Clinic Hospital.

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ELLIOTT C. CUTLER

ELLIOTT CARR CUTLER, M.D., F.A.C.S., Boston, Massachusetts, is a graduate of Harvard University and Harvard Medical School. He also holds an honorary doctorate from the University of Strasbourg. Dr. Cutler held the following posts at various times: Surgical house officer, Peter Bent Brigham Hospital; resident surgeon, Massachusetts General Hospital; alumni assistant in surgery, Harvard Medical School; voluntary assistant at Rockefeller Institute; instructor in surgery at Harvard; associate in surgery, Peter Bent Brigham Hospital; professor of surgery, Western Reserve University School of Medicine, and director of the surgical service, Lakeside Hospital, Cleveland. During the World War he held the various ranks of Lieutenant, Captain, Major and Lieutenant Colonel and was decorated with the Distinguished Service Medal. At present he is consulting surgeon to New England Peabody Home for Crippled Children, Moseley Professor of Surgery, Harvard Medical School and surgeon-in-chief to Peter Bent Brigham Hospital. His hobbies are fishing, old medical books, golf, tennis and the collecting of stamps.

CHARLES A. ELSBERG

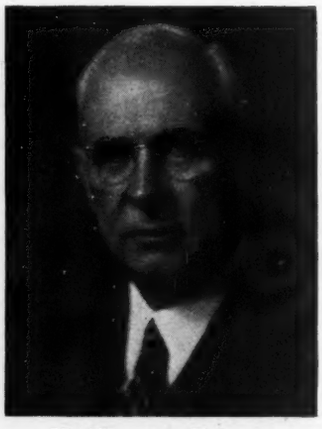
CHARLES ALBERT ELSBERG, M.D., F.A.C.S., New York, New York, is a graduate of the College of Physicians and Surgeons, Columbia University. He was at one time honorary consultant to the Police Department of New York City, contract surgeon to the New York Neurosurgical School and to the United States Army General Hospital No. 1. Formerly he was president of the American Neurological Association and of the Association for Research in Nervous and Mental Disease. Dr. Elsberg, who specializes in neurosurgery, is at present Professor Emeritus of Neurosurgery at the College of Physicians and Surgeons, Columbia University, Surgeon-In-Chief Emeritus to the Neurological Institute and consulting surgeon to Mount Sinai, Knickerbocker, Manhattan State and Ward's Island Hospitals, in New York City, and Vassar Brothers Hospital in Poughkeepsie, New York.

Herbert C. Fett

HERBERT C. FETT, M.D., F.A.C.S., Brooklyn, New York, was graduated from Long Island College of Medicine in 1913. He is now orthopedic surgeon to Long Island College, St. Mary's, St. Peter's, Holy Family and St. Charles (Port Jefferson) Hospitals, consulting orthopedic surgeon to South Side (Bay Shore) and Huntington Hospitals and director of the Fracture Service, Greenpoint Hospital. Dr. Fett is clinical professor of orthopedic surgery at Long Island College of Medicine and a Fellow of the American Board of Orthopaedic Surgery.

C. R. G. Forrester

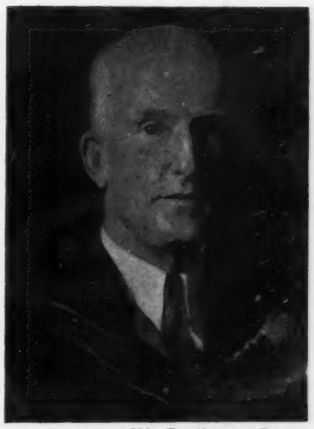
C. R. G. FORRESTER, M.D., F.A.C.S., Chicago, Illinois, was born in Houghton, Michigan, in 1880. He attended college in Toronto, Canada, was graduated from the Medical Department of Loyola University, and did postgraduate work in Vienna, Austria. During the World War he served in the Alder Hey Military Hospital. He is now on the staffs of the Chicago Memorial, Edgewater and St. Joseph's Hospitals, and is a member of the Institute of Traumatic Surgery and of the Chicago Medical Society. Dr. Forrester is the author of "Imperative Traumatic Surgery" and of numerous surgical articles. He is now occupied in consultation practice on bone and peripheral nerve surgery.



H. Dawson Furniss

HENRY DAWSON FURNISS, M.D., F.A.C.S., LL.D., New York, was born in Selma, Alabama, in 1878. He attended the University of Alabama and was graduated from the University of Virginia in 1899. During the war he was a Captain of the United States Army. Dr. Furniss did postgraduate work in Berlin from 1901 to 1902. At one time he served as professor of gynecology, New York Post-Graduate Hospital, and is now clinical professor of surgery at New York University Medical College. He is also consulting gynecologist to New York Post-Graduate Hospital and to a number of institutions in New Jersey. At the New York Infirmary for Women and Children he is the consulting cystoscopist and is surgeon to Flower-Fifth Avenue Hospital. He has made a goodly number of contributions to medical literature and has invented several useful surgical instruments.

JOHN HEYSHAM GIBBON, M.D., Media, Pennsylvania, was born at Charlotte, North Carolina. He received his preparatory education at the Macon School and his medical degree from Jefferson Medical College, Philadelphia. From 1907 to 1931 he was professor of surgery and clinical surgery at Jefferson Medical College. During the Spanish American War he was surgeon to the U. S. Vol. Engrs. and was Colonel and consultant in surgery with the A.E.F. during the World War. Following his return from France in 1919, a number of papers appeared on his experience gained during the war in the treatment of wounds and infections. He has been a devoted teacher of the art and practice of surgery and his didactic lectures were always models of clarity and precision. Consequently, note taking was easy and inattention rare during the lecture hour. Dr. Gibbon now lives on his farm where, since his retirement from active surgery, he has devoted himself to extremely skillful and enthusiastic performance in carpentry, woodcarving and cabinet making.



W. Coulbourn Brown

JOHN H. GIBBON

EMIL GOETSCH, M.D., PH.D., Brooklyn, New York, was born in Davenport, Iowa. He received his academic degree at the University of Chicago and his degree in medicine from Johns Hopkins University Medical School. He was formerly president of the American Association for the Study of Internal Secretions and associate professor of surgery at Johns Hopkins Medical School. He is one of the founders of the American Board of Surgery and an honorary member of the Royal Surgical Society of Rome. At present he is active as professor of surgery, Long Island College of Medicine, and surgeon-in-chief to Long Island College Hospital. Dr. Goetsch's specialty is thyroid surgery.

Underwood & Underwood

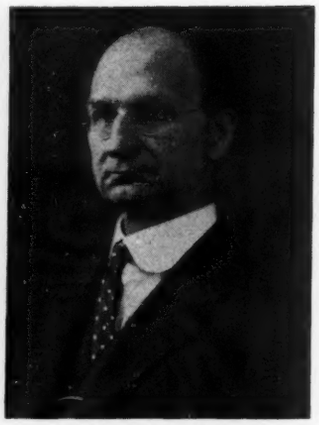
EMIL GOETSCH

CHARLES ALBERT GORDON, M.D., F.A.C.S., Brooklyn, New York, was born in 1883. He was graduated from Cornell University Medical College in 1905 and now specializes in gynecology and obstetrics. At one time he served as chairman of the Committee on Maternal Welfare, Medical Society of the County of Kings and of the Medical Society of the State of New York, and is the ex-president of the Medical Society of the County of Kings and of Brooklyn Gynecological Society. He is now professor of obstetrics and gynecology and the director of obstetrics and gynecology, Long Island College of Medicine; attending gynecologist and obstetrician to St. Catherine's Hospital and consulting gynecologist and obstetrician to Greenpoint and Beth-El Hospitals. He also holds numerous other gynecological and obstetrical posts.

CHARLES A. GORDON

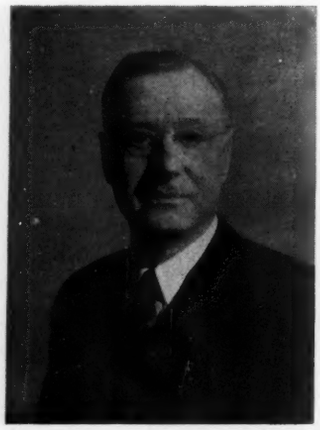
Donald Guthrie

DONALD GUTHRIE, M.D., F.A.C.S., Sayre, Pennsylvania, was born at Wilkes-Barre in 1880. He received his bachelor's degree at Yale, his degree of medicine at the University of Pennsylvania School of Medicine, and an honorary degree of doctor of science from Lafayette College. He is an ex-president of the Pennsylvania Medical Society, one of the thirteen organizers of the American Board of Surgery and is a member of the Board of Governors of the American College of Surgeons. In 1938, he was associate professor of surgery at the Graduate School of Medicine, University of Pennsylvania, and since 1910 has been surgeon on the staff of the Guthrie Clinic and Robert Packer Hospital.



Arthur E. Hertzler

ARTHUR E. HERTZLER, M.D., F.A.C.S., Halstead, Kansas, was born at West Point, Iowa, on July 26, 1870. He was graduated from Northwestern University in 1894 and attended the University of Berlin from 1899 to 1901. Dr. Hertzler is now connected with Halstead Hospital but formerly was on the staffs of St. Luke's, St. Mary's and Kansas City General Hospitals. Dr. Hertzler's practice is confined to skin disorders and he states that he has been "accused" of being a surgeon. His only claim to distinction is that he has never held an office and has never been threatened with one. He asserts that his routine has been just plain hard work seven days a week and that he has always been too tired to take a vacation. He is the author of the well known and widely read "Horse and Buggy Doctor," a delightful work published by Harper and Brothers.



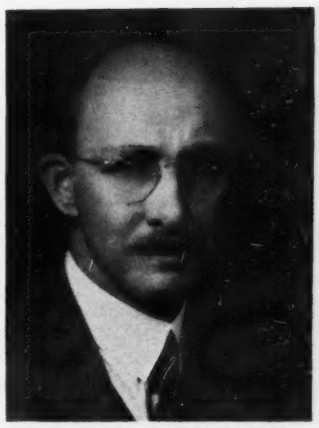
Louis J. Hirschman

LOUIS J. HIRSCHMAN, M.D., F.A.C.S., Detroit, Michigan, was born in Republic, Michigan, in 1878. Dr. Hirschman, who is a proctologist, specializes in surgery of the anus, rectum and colon. He received his degree in medicine at Detroit College of Medicine in 1899. He is one of the founder members of the American College of Surgery and during the World War was a Major in the Medical Corps of the American Expeditionary Forces at Base Hospital No. 17. He is now the president of the American Board of Proctology and is proctologist and head of the Department of Proctology at Harper, Women's and Charles Godwin Jennings Hospitals, and consulting proctologist to Detroit Receiving Hospital, Evangelical Deaconess, St. Joseph's Mercy and U. S. Marine Hospitals. In addition Dr. Hirschman is the extramural lecturer in postgraduate medicine at the University of Michigan. He has written "Handbook of Diseases of the Rectum," "Synopsis of Ano-Rectal Diseases," and is the co-author of the Year Book of Anesthesia published 1915 to 1918. He is also on the editorial boards of The Review of Gastroenterology and the American Journal of Digestive Diseases.

FREDERICK CLARK HOLDEN, M.D., F.A.C.S., New York, New York, is a specialist in obstetrics and gynecology. He was graduated from New York University in 1892 and served an internship at St. Mary's Hospital, Brooklyn, for one year. He was an assistant attending surgeon to St. Mary's Hospital, assistant attending gynecologist to Williamsburg Hospital and assistant attending obstetrician and gynecologist to Long Island College Hospital. From 1919 to 1934 he was connected with Bellevue Hospital, first, as director of the Gynecological Service and later as director of obstetrics and gynecology. At present Dr. Holden is attending obstetrician and gynecologist to French Hospital and consulting obstetrician and gynecologist to Bellevue Hospital and is active as consulting obstetrician and gynecologist to a number of hospitals both in New York and New Jersey. He is a Diplomate of the American Board of Obstetrics and Gynecology and Emeritus Professor of Obstetrics and Gynecology at New York University Medical College.

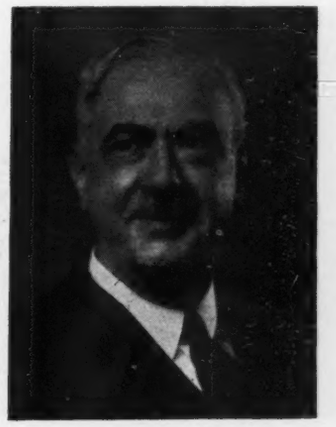
FREDERICK C. HOLDEN

EMILE F. HOLMAN, M.D., F.A.C.S., San Francisco, California, was born in Moberly, Missouri, in 1890. He received his academic degrees at Stanford University and Oxford University, and his degree in medicine from Johns Hopkins University Medical School in 1918. He was a member of the Commission for Relief in Belgium from 1914 to 1915. In 1930, he was visiting professor of surgery at Peiping Union Medical College, Peiping, China, and that same year won the Samuel J. Gross Prize in Surgery. From 1936 to 1937 he was vice-president of the American College of Surgeons. At the present time he is professor of surgery at Stanford University School of Medicine and an executive in the Department of Surgery of Lane and Stanford Hospitals.

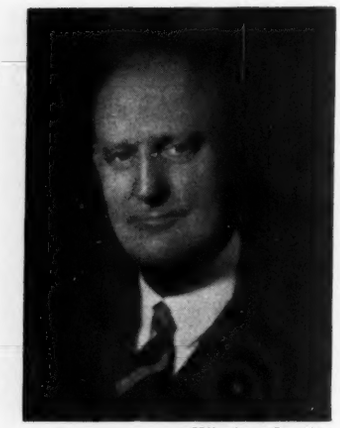


EMILE F. HOLMAN

JOSEPH ANDREW HYAMS, M.D., F.A.C.S., New York, New York, is a graduate of the College of Physicians and Surgeons, Columbia University. At one time he acted as chairman of the Genito-Urinary Section of New York Academy of Medicine and of the Medical Board of Community Hospital. He has also been president of New York Physicians—Yorkville Medical Society. He is now director of urology at New York Post-Graduate Medical School and Hospital, Columbia University and of Gouverneur Hospital; attendant urologist to the Urology Reconstruction Hospital and consulting urologist to All Souls Hospital, Morristown, New Jersey, St. Francis Hospital, Port Jervis, New York, and Beth David Hospital, New York City.



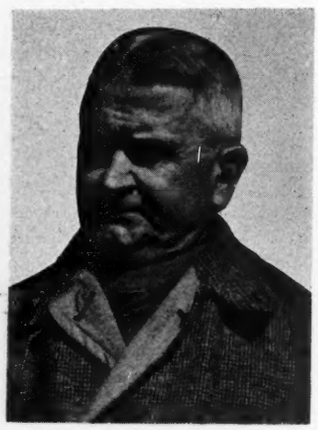
JOSEPH A. HYAMS



Windsor Studios

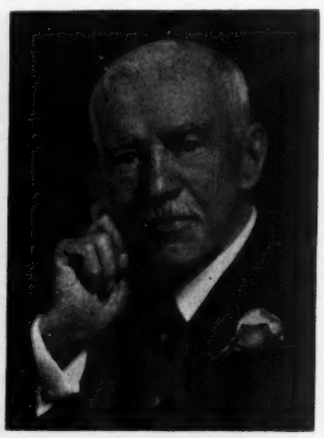
JOHN E. JENNINGS

JOHN EDWARD JENNINGS, M.D., F.A.C.S., Brooklyn, New York, was born in 1875 at South Rutherford, New Jersey. He attended Rutgers Preparatory School, Rutgers College and the College of Physicians and Surgeons, Columbia University. In 1925, Dr. Jennings was president of the Medical Society of the County of Kings and has been a Regent of the American College of Surgeons. He also holds the title of Lieutenant Colonel of the A.E.F., U. S. Army. He is now acting as senior surgeon to Brooklyn Hospital, surgeon-in-chief to St. John's Hospital, surgeon to St. Peter's Hospital, consulting surgeon to Huntington, Nassau, Beth-El, Norwegian, Lutheran, Bethany-Deaconess, Cumberland, Caldenonian, Brooklyn Woman's, Midwood and Bay Ridge Hospitals.



WILLIAM L. KELLER

WILLIAM LORDAN KELLER, M.D., F.A.C.S., Washington, D.C. was born in 1874 at East Hartford, Connecticut. He is particularly interested in general and thoracic surgery. Soon after he was graduated from the Medical College of Virginia in 1899 he became acting assistant surgeon to the United States Public Health Service. From 1902 to 1935 Dr. Keller was a medical officer in the U. S. Army and served in all grades from First Lieutenant to Colonel. He retired from that service at his own request after thirty years of duty. Dr. Keller served on the surgical service of army hospitals throughout his entire military career. He was director of Profession Services with the Headquarters of the A.E.F. in France during the World War and was awarded the Distinguished Service Medal for this work. From 1919 to 1935 he was the chief of the surgical service at Walter Reed General Hospital, and during those same years was instructor in surgery at the Army Medical School, Washington, D.C.



HOWARD A. KELLY

HOWARD ATWOOD KELLY, M.D., F.A.C.S., LL.D., Baltimore, Maryland, received his academic and medical degrees from the University of Pennsylvania. He is a well known surgeon and *x*-ray therapist. In 1907, he was president of the Southern Surgical and Gynecological Society and in 1912 president of the American Gynecological Society. Dr. Kelly established a hospital in Kensington, Philadelphia, which was later incorporated as Kensington Hospital for Women. In 1892, he established another hospital in Baltimore which afterward was incorporated as the Howard A. Kelly Hospital. Dr. Kelly is one of the pioneer radiologists and purchased the first radium in 1904, and it was he who insisted upon the use of large amounts of radium. He also was instrumental in bringing Max Broedel from Leipzig for the purpose of illustrating Kelly's gynecological writings, and because of this, medical illustration in this country and elsewhere has been transformed. Dr. Kelly is now Emeritus Professor of Gynecology of Johns Hopkins University Medical School and surgeon and *x*-ray therapist to the Howard A. Kelly Hospital. He is the author of a number of textbooks and several hundred articles.

THOMAS JOSEPH KIRWIN, M.D., F.A.C.S., New York, New York, was born at Frederick, Maryland, in 1889. He studied at the University of Michigan, Tulane, Cornell, Columbia and Yale Universities, and is certified by the Board of Urology. He served as Captain of the U.S. Medical Corps, in France, during the World War. Dr. Kirwin has devised a number of instruments known as Kirwin vesical neck resector, Kirwin prostatic resector, Kirwin lithotritex and Kirwin radon implanter. With Dr. Lowsley he is the author of a number of books including "Textbook of Urology," and "Urology for Nurses," and has written many papers on urological subjects. Dr. Kirwin is a member of many well known medical and surgical organizations and at present is chief of the urology clinic, James Buchanan Brady Foundation and adjunct visiting urologist to New York Hospital, consulting urologist to Coney Island Hospital, Brooklyn, St. Vincent's Hospital, Montclair, New Jersey, Benedictine Hospital, Kingston, New York, and visiting genitourinary surgeon to City Hospital, New York City.

Thomas J. Kirwin

ARTHUR KRIDA, M.D., F.A.C.S., New York, New York, was born in Poland in 1888. He was graduated from Albany Medical College and his specialty is orthopedic surgery. He was formerly chairman of the Orthopedic Section of both the New York Academy of Medicine and the New York State Medical Society. From 1917 to 1919 he was a Captain in the U. S. Army Medical Corps. At present he is professor of orthopedic surgery, New York University Medical College; attending orthopedic surgeon to Bellevue; consulting orthopedic surgeon to Lutheran, North Hudson, U.S. Marine, Saratoga, St. Agnes, Beth Israel and Knickerbocker Hospitals. He has contributed to the profession many original ideas relative to knee joint surgery, congenital dislocation of the hip and splay-foot operation.

Arthur Krida

MAURICE LENZ, M.D., New York, New York, was born in Kovno, Russia, in 1890. He studied at New York University and Bellevue Medical School and at the College of Physicians and Surgeons, Columbia University. Dr. Lenz also studied at the Curie Institute in Paris, France, and at Freiburg, Germany. During the World War he was stationed at the base hospital in the south of France and served in the Medical Corps. Some years ago he was vice-president of the American Radium Society and in 1937 and 1938 was chairman of the Standardization Committee of the American Radium Society. At present he is chief of the Radiotherapy Department of Presbyterian and Montefiore Hospitals; consulting radiotherapist to United Hospital, Port Chester, New York, North Hudson Hospital, Weehawken, New Jersey, and associate professor of clinical radiology at Columbia University.

Maurice Lenz

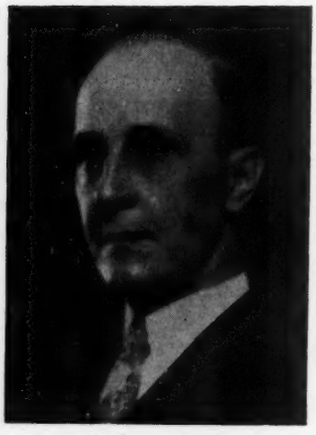
H. H. M. Lyle

HENRY HAMILTON MOORE LYLE, M.D., F.A.C.S., New York. New York, was graduated from Columbia University in 1900. He served an internship for two years at St. Luke's hospital. During the World War, Dr. Lyle was active as surgeon-in-chief to the American Ambulance Hospital. He organized and took abroad Evacuation Hospital U.S.A. No. 2. This was the first army hospital to be commanded and taken abroad by a reserve office. He was made a Lieutenant Colonel in 1918, was also appointed consulting surgeon to the 77th Division in September, 1918, and was decorated for his services by the United States and England. Since 1931 he has been professor of clinical surgery at Cornell University Medical School, and is also attending surgeon to St. Luke's Hospital, director of Cancer Service, Skin and Cancer Hospital, attending surgical specialist to the United States Veteran's Bureau, District No. 2 and consulting surgeon to Elizabeth A. Horton Memorial Hospital, Middletown, New York, New York State Reconstruction Home, West Haverstraw, New York, and St. Luke's Hospital, Newburgh, New York.

Harris & Ewing

Jerome M. Lynch

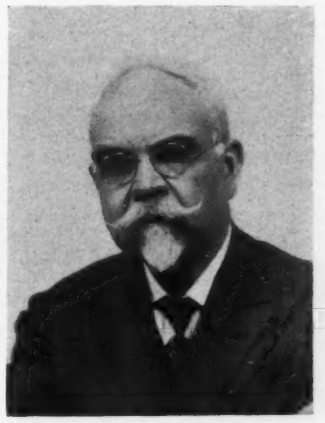
JEROME MORLEY LYNCH, M.D., New York, New York, was born in Ireland. He attended Queen's College, Cork, Ireland, and was graduated from Rush Medical College in 1895. He served as Lieutenant Commander of the U.S. Naval Reserve Transport "America" during the World War. He was an instructor in proctology at Cornell Medical School for five years and also surgeon and chief at St. Bartholomew's Hospital, New York City. For twenty-five years he has been professor of proctology and colonic surgery at the New York Polyclinic Medical School and Hospital. He is also consultant in surgery to the Neurological Institute, New York, Broad Street and Mary Thompson Hospitals. Dr. Lynch has contributed largely to the literature of his specialty. He is the author of the chapters on rectocolic surgery for Johnson's "Surgery," Woods' "Handbook of Medical Science" and Tice's "System of Medicine." He has also written "Diseases of Rectum and Colon" and "Tumors of the Colon and Rectum."



Urban Maes

URBAN MAES, M.D., F.A.C.S., New Orleans, Louisiana, was graduated from Tulane University in 1900. He was made a Lieutenant Colonel during the World War. From 1929 to 1933 he was on the Board of Governors of the American College of Surgeons and has held important offices in other prominent surgical organizations. He is now chairman of the Executive Committee, professor of surgery and director of the Department of Surgery at Louisiana State University School of Medicine; consultant in surgery to Touro Infirmary and senior visiting surgeon to Charity Hospital of Louisiana at New Orleans.

RUDOLPH MATAS, M.D., F.A.C.S., New Orleans, Louisiana, was born in Bonnet Carré, Louisiana, in 1860. He studied in Paris, France, and Barcelona, Spain, and received his medical degree from Tulane University in 1860. He is Professor Emeritus of Surgery of both New Orleans Polyclinic Post-Graduate School and Tulane University. From 1894 to 1928 he was senior surgeon to Charity Hospital and for thirty years was the chief surgeon to Touro Infirmary. He was the organizer and director of Base Hospital No. 24, the Tulane Unit for service in France during the first World War, and he is a member of numerous societies both here and abroad. In 1926, he was the Henry Bigelow Medalist for distinguished contributions to the advancement of surgery. Dr. Matas is the author of many treatises and monographs on surgical subjects especially surgery of the blood vessels.



RUDOLPH MATAS

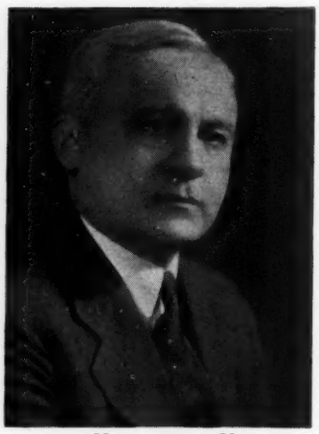
ROY DONALDSON McCLURE, M.D., F.A.C.S., Detroit, Michigan, received his academic degree at Ohio State University and his degree in medicine at Johns Hopkins University. He also studied at the University of Prague, Bohemia, in 1906. From 1918 to 1919 he served as Major of the Medical Corps, U.S.A., and was commanding officer of Evacuation Hospital No. 33, of the A.E.F. He acted as house surgeon to New York Hospital, assistant resident to Johns Hopkins Hospital and was instructor of surgery at Johns Hopkins Medical School for four years. He was assistant to Dr. Alexis Carrel from 1907 to 1908 at the Rockefeller Institute in the work on transplantation of organs, for which Carrel received the Nobel prize. Dr. McClure is the author of numerous papers in both experimental and clinical fields. At present he is surgeon-in-chief to Henry Ford Hospital, consulting surgeon to Receiving Hospital, extramural lecturer in postgraduate medicine, at the University of Michigan, and regional representative of the Commission on Admissions of Johns Hopkins and Duke Universities.

Blackstone Studios

ROY D. McCLURE

HOWARD C. NAFFZIGER, M.D., F.A.C.S., San Francisco, California, is a neurological surgeon. He received both his academic and medical degrees at the University of California. After graduation he received his surgical training at the University of California Hospital and Johns Hopkins Hospital. He is a member of a number of well known medical and surgical societies and is professor of surgery and chairman of the Department of Surgery at the University of California Medical School, surgeon-in-chief to the University of California Hospital, and neurological surgeon to U. S. Veteran's Administration Hospital.

H. C. NAFFZIGER



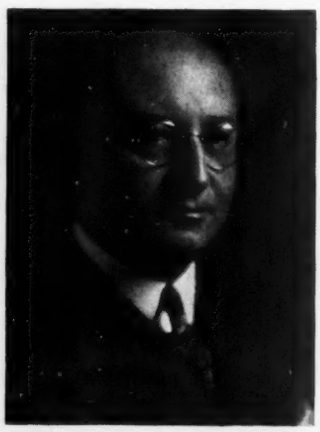
Underwood & Underwood

EMIL NOVAK

EMIL NOVAK, M.D., F.A.C.S., Baltimore, Maryland, specializes in gynecology. He is a graduate of Loyola College, Baltimore, and of the University of Maryland. He did postgraduate work in Berlin and Vienna and received an honorary degree of Doctor of Science from Trinity College, Dublin. Dr. Novak has written numerous articles chiefly in the fields of gynecological pathology and endocrinology. He is the author of "Menstruation and Its Disorders," "The Woman Asks the Doctor" and "Gynecological and Obstetrical Pathology" and of sections or chapters in Curtis' "Obstetrics and Gynecology," Lewis' "Practice of Surgery" and the "Oxford System of Medicine." He is now associate in gynecology, at Johns Hopkins Medical School, associate professor of obstetrics at the University of Maryland Medical School; gynecologist and chief of staff, Bon Secours Hospital, visiting gynecologist to St. Agnes Hospital and the Hospital for Women. He is the founder and first president of the Gynecological and Obstetrical Society of Baltimore.

CLARENCE R. O'CROWLEY

CLARENCE RUTHERFORD O'CROWLEY, M.D., F.A.C.S., Newark, New Jersey, was graduated from the College of Physicians and Surgeons, Columbia University, in 1904, and has specialized in urology for over thirty years. He is a Diplomate of the American Board of Urology and a charter member of the American College of Surgeons. He is also assistant professor of urology at the Graduate School of the University of Pennsylvania and is attending surgeon and chief of the Department of Urology of Newark City Hospital, and attending surgeon to Newark, Beth Israel and Presbyterian Hospitals, Newark, New Jersey, and St. Mary's Hospital, Orange, New Jersey. He is a past president of the American Urological Association and of the Society of Surgeons of New Jersey. Dr. O'Crowley is consulting urologist to a number of hospitals in New Jersey and a member of well known urological societies both here and abroad.



Garo

LOUIS E. PHANEUF

LOUIS EUSÈBE PHANEUF, M.D., F.A.C.S., Boston, Massachusetts, was born in Canada in 1884. His specialties are gynecology and obstetrics. He was graduated from Tufts College Medical School (summa cum laude) in 1913. He is the professor of gynecology at Tufts College Medical School, gynecologist and obstetrician-in-chief to Carney and Malden Hospital, and surgeon of the Department of Gynecology of the New England Medical Center. He is active as consulting gynecologist to Beth Israel Hospital, Boston, and to other hospitals in Massachusetts and Maine. He is also a member of numerous medical and surgical societies in the United States and Europe. In December, 1938, Dr. Phaneuf received the decoration of Officer of the Order of the Crown from King Leopold III of Belgium.

EUGENE HILLHOUSE POOL, M.D., F.A.C.S., New York, New York, attended Harvard University and the College of Physicians and Surgeons, Columbia University. At one time he was elected president of the New York Academy of Medicine, the American Surgical Association and the American College of Surgeons. During the World War he served overseas as a Lieutenant Colonel of the Medical Corps. At present he is professor of clinical surgery, Cornell University Medical College, senior attending surgeon to New York Hospital, Surgeon-in-Chief Emeritus, of the Hospital for Ruptured and Crippled, and consulting surgeon to French, Woman's and Presbyterian Hospitals, and to the Harlem Infirmary for Women and Children.

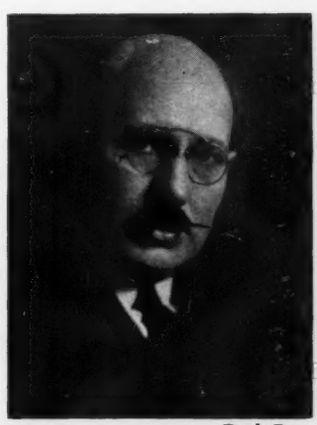
EUGENE H. POOL

JAMES TAGGART PRIESTLEY, M.D., F.A.C.S., Rochester, Minnesota, was born in Des Moines, Iowa, in 1903. He received his academic and medical degrees from the University of Pennsylvania and his Ph.D. in surgery from the University of Minnesota. He is a member of the American College of Surgeons, the American Board of Surgery and the Clinical Society of Genito-Urinary Surgeons. He is the head of a section in the Division of Surgery at the Mayo Clinic, and assistant professor of surgery at the Mayo Foundation, University of Minnesota.

Gilbert Woodcock

JAMES T. PRIESTLEY

DOUGLAS QUICK, M.D., F.A.C.S., New York, New York, was born in Ontario, Canada. He is a graduate of the University of Toronto Faculty of Medicine and specializes in the treatment of cancer and allied diseases. He is the former president of the American Radium Society and a member of numerous radiological societies. Dr. Quick became associated with the late Dr. H. H. Janeway as his assistant in 1916 and since that time has devoted his energies entirely to the treatment of cancer. It is Dr. Quick's belief that he and Dr. Janeway were the first clinicians in this country to devote all their time to the clinical care of malignant neoplastic diseases. This entailed both surgical and radiological care and served to combine surgery and radiology rather than leaving it separated in different hands. Dr. Quick has been in the capacity of assistant surgeon to City Hospital, assistant surgeon and attending surgeon to Memorial Hospital and director of radiology to Memorial Hospital.



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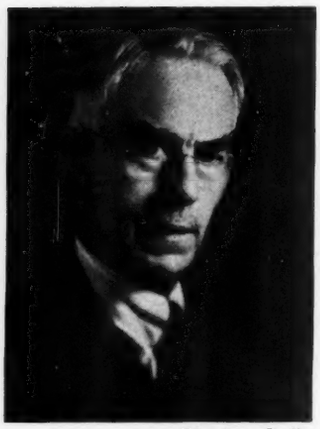
DOUGLAS QUICK



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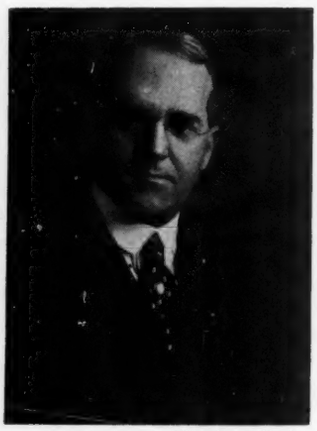
NATHANIEL P. RATHBUN

NATHANIEL PHILIP RATHBUN, M.D., F.A.C.S., Brooklyn, New York, was born in Springfield, Massachusetts. He is a graduate of Long Island College Hospital and a specialist in urology. He is the former chairman of the Genito-Urinary Section of the New York Academy of Medicine and acted as president of the New York Urological Society and the American Urological Society. He is the chief of urology to Brooklyn Hospital and consulting urologist to Lutheran, Norwegian, Beth-El, Bushwick and Eastern Long Island Hospitals.



Harris & Ewing

HUBERT A. ROYSTER

HUBERT ASHLEY ROYSTER, M.D., F.A.C.S., Raleigh, North Carolina, was educated at Raleigh Male Academy, Wake Forest College and the University of Pennsylvania. He served a one-year internship at Mercy Hospital, Pittsburgh, and was surgeon to Rex Hospital from 1897 to 1938. Dr. Royster has travelled extensively in order to pursue postgraduate courses and to observe the work of prominent surgeons both here and abroad. He was surgeon-in-chief to St. Agnes Hospital and consulting surgeon to a number of railway corporations. He was one of the founder members of the American College of Surgeons and of the American Board of Surgery, and in 1926 was elected president of the Southern Surgical Association. Dr. Royster is the author of three books: "Syllabus of Therapeutics," "Appendicitis" and "Medical Morals and Manners." He has also written numerous articles which have appeared in leading magazines and newspapers. In April, 1938, he retired from active professional work.

HENRY S. RUTH

HENRY SWARTLEY RUTH, M.D., Merion, Pennsylvania, a graduate of Swarthmore College and Hahnemann Medical College and Hospital, has devoted his professional activities exclusively to anesthesiology since 1924. At the present time he is the Editor of Anesthesiology, the official organ of the American Society of Anesthetists. He is also anesthetist to Hahnemann, St. Luke's and Children's Hospitals, chief of the Division of Anesthesia, Philadelphia General Hospital, chief anesthetist to Broad Street Hospital, Philadelphia, and clinical professor of anesthesia at Hahnemann Medical College and Hospital. Dr. Ruth has also held the office of president of a number of societies for anesthetists and is the vice-president of the American Board of Anesthesiology.

M. G. SEELIG

M. G. SEELIG, M.D., F.A.C.S., St. Louis, Missouri, is a general surgeon. He received his academic degree at Harvard University in 1896 and his degree in medicine at the College of Physicians and Surgeons, Columbia University, in 1900. He is a retired Colonel of the Medical Corps of the U. S. Army and a professor of clinical surgery at Washington University, consultant in surgery to Jewish Hospital, and director of pathology at Barnard Free Skin and Cancer Hospital.

Peter A. Juley & Son

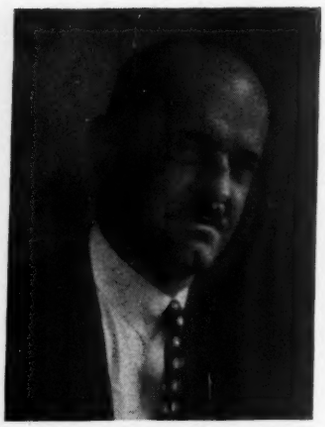
J. BENTLEY SQUIER

JOHN BENTLEY SQUIER, M.D., F.A.C.S., New York, New York, received his medical degree at the College of Physicians and Surgeons, Columbia University, in 1894. He was attending surgeon to the Department of Charities, New York City, for twelve years, and professor of genitourinary surgery at New York Post-Graduate Medical School from 1909 to 1924. He is the director of the Squier Urology Clinic, the originator of Columbia War Hospital and a member of the General Medical Board of the Council on National Defense. Dr. Squier resigned his position as professor of genitourinary surgery at Columbia University in June, 1939, and received the appointment of Professor Emeritus. He is the author of numerous monographs on subjects relating to surgery of the bladder and kidneys.

Kazanjian

H. J. STANDER

HENRICUS JOHANNES STANDER, M.D., F.A.C.S., New York, New York, was born in 1894 at Georgetown, Cape Province, South Africa. Dr. Stander studied at South African College, Harvard University, the University of Arizona and Yale University. At one time he was chemist to the Hercules Powder Company, associate in obstetrics to Johns Hopkins Hospital, on the house staff of the Royal Victoria Hospital, Montreal, and associate professor of obstetrics, Johns Hopkins Hospital. He is now professor of obstetrics and gynecology, Cornell University Medical College, obstetrician and gynecologist-in-chief to New York Hospital, director of Lying-In Hospital and chief of staff of the Berwind Free Maternity Clinic.



GRANT E. WARD

GRANT EBEN WARD, M.D., F.A.C.S., Baltimore, Maryland, was graduated from Johns Hopkins Medical School in 1921. Dr. Ward specializes in surgery and radium therapy. He is a Fellow of the American Congress of Physical Therapy and was chairman of the Eastern Section of that organization in 1935. Dr. Ward is a member of the American Medical Editors and Authors Association and of the American Association for the Study of Neoplastic Diseases. He is now associate professor of surgery, School of Medicine, University of Maryland; associate in surgery, Johns Hopkins University, assistant visiting surgeon and assistant dispensary surgeon to Johns Hopkins Hospital, visiting oncologist to Baltimore City Hospitals, and lecturer in oral oncology, Baltimore College of Dental Surgery, Dental School, University of Maryland.

J. HOMER WOOLSEY

JOHN HOMER WOOLSEY, M.D., F.A.C.S., Woodland, California, was born in New York in 1889, and was graduated from the University of California Medical School. Dr. Woolsey served in the U.S. Army Medical Corps overseas from 1917 to 1919, and has also been a member of the Board of Governors of the American College of Surgeons. He is now associate clinical professor of surgery at the University of California Medical School and surgeon to the Woodland Clinic. He is also the author of a number of articles on various aspects of surgery which have been published in national and state medical journals.

JAMES MORLEY HITZROT, M.D., F.A.C.S., New York, New York, was born in 1875 at McKeesport, Pennsylvania. He attended Princeton in 1897 and was graduated from Johns Hopkins University Medical School in 1901. At present he is consulting surgeon to New York Hospital, Nassau Hospital, Mineola, New York, North County Community Hospital, Glencove, New York, and Norwalk General Hospital, Norwalk, Connecticut.

ADRIAN V. S. LAMBERT, M.D., F.A.C.S., New York, New York, received his academic degree at Yale University and his degree in medicine at the College of Physicians and Surgeons, Columbia University in 1896. From 1939 to 1940 he was president of the American Association for Thoracic Surgery and at present is clinical professor of surgery at Columbia University. His specialty is general surgery.

HARRISON STANFORD MARTLAND, M.D., Newark, New Jersey, attended the College of Physicians and Surgeons, Columbia University, and after graduation interned for eighteen months at New York City Hospital. He then spent a period of two years in pathology and bacteriology at the Russell Sage Laboratory, after which he was appointed pathologist to Newark City Hospital. Dr. Martland entered the army in 1917 as a member of the Bellevue Hospital Unit. His services were so distinguished that he was made a colonel in the reserve corps. Dr. Martland's pathological museum at City Hospital, which was built up mostly through his own efforts, has come to be known as one of the best in the country. In 1916, Dr. Martland began to write for publication. Since then he has written more than fifty medical papers and two original books entitled "Punch Drunk" and "Dr. Watson and Mr. Sherlock Holmes." He also published a series of articles showing the results of occupational poisoning. During 1934 and 1935 he was the editor of the Section on Forensic Medicine in The American Journal of Surgery. In 1935, he received an honor that usually does not come during a doctor's lifetime: The Essex County Anatomical and Pathological Society established the Harrison Stanford Martland Lectures.

Original Articles

THE PAST HALF CENTURY AND MEDICAL EDUCATION

RAY LYMAN WILBUR, M.D.
President, Stanford University
SAN FRANCISCO, CALIFORNIA

FIFTY years ago medical education in this country felt the first sharp impact of the laboratory. Over the centuries medicine had been built up through observation and experience. Great figures, such as Hippocrates, Galen, Paracelsus and Vesalius, had been used as foundation stones in the building of medicine. Theirs were the voices of authority, for they had both knowledge and wisdom. It is remarkable how much the contributions of men like Hunter, Harvey, Jenner and Lister were used in the every-day work of the physician. The practice of medicine was an art, and only artists with unique personal equipment could gain leadership in it. The inklings of a new era wherein facts became supreme appeared with the rapid development of chemistry, which when applied to medicine began to indicate the possibilities of a study of the various body fluids and the changes taking place in them with disease. The beaker and crucible were soon joined by the microscope and thermometer in uncovering new knowledge of the way the body reacted to sickness. The microscopic enemies of man were brought to light.

In the eighties and nineties of the last century the studies of Pasteur, Koch, Behring, Ehrlich and others led directly to the destruction of the commercial medical schools which were in full blossom in America at that period. It was the costs of the necessary laboratories and the payment of the instructors working in them that took the bottom out of schools supported by student fees. Endowment funds or large appropriations for annual support were required in order to give medical training that prepared for a medical practice based more and more on research and the laboratory.

At the same time the growing laboratories in the various fields of medicine made it imperative to require premedical training in chemistry, physics and biology. Greek, Latin and philosophy opened no laboratory doors, even though they did open the doors of the mind.

One can look back now and see the great drama that took place in medical education both in Europe and America. In the United States within a comparatively few years the number of commercial medical schools was strikingly rêduced, university medical schools were organized, the length of the medical course was markedly increased, the number of medical students diminished, and there began that transformation that has advanced medical education in America so that it is the peer of that of any other country in the world.

It was the physician who saw the need of using the constantly growing knowledge and who was willing to make the personal sacrifices that go with change. The American doctor, acting through the American Medical Association, began a campaign for better instruction, better procedures in licensure of physicians and surgeons and larger campaigns for the general support of medical education. The American public was far behind the profession in its understanding of what was required, so that we have had fifty years of constant battles against ignorance and those who profited

in some degree from letting things go as they were.

It has not been easy to keep medical education in tune with discoveries and change. The death of any educational institution is always accompanied by many signs of distress and by strong opposition from those associated with it as faculty or as alumni. When we realize that thirty odd years ago Illinois had fifteen medical schools, Missouri fourteen, Maryland eight, Kentucky seven and Tennessee ten, we can best understand what this process has been. There were homeopathic and eclectic schools, as well as those that were called allopathic or regular. The disappearance of those words from daily use indicates the shift from doctrinaire points of view in medicine to medicine as a science.

Medicine itself had to undergo a transformation in the minds of the profession and in the minds of the public. So unusual were the developments coming out of the laboratory with the discoveries of the tubercle bacillus, the typhoid bacillus, the pus forming organisms, the plasmodium of malaria and on through to the spirochete of syphilis, that there was a constant uncovering of new information in those fields of medicine that had been most constantly cultivated over the years. The blind spots became fewer. Remedies became more specific and effective. Antidiphtheric serum and salvarsan began their life-saving service, while the surgeon was daring to explore more and more of the human frame to uncover and relieve successfully existing pathologic conditions.

Every part of the medical curriculum felt the impulse from the laboratory, the autopsy table and the operating room. Pathology became a key subject and influenced profoundly both medicine and surgery. New editions of the textbooks of anatomy came out without emphasis upon how to reach the organs of the body without involving the peritoneum. Aseptic surgery opened up a new era in the treatment of all sorts of pathologic conditions that had been allowed to destroy the patient or to reach proportions so that an operation was looked upon as a last resort. Not only was the content of the medical course markedly changed but it was soon increased in length and the intern year became almost universal.

The commercial medical school had depended largely upon the lecture system, which was no longer applicable to much of the work of the laboratory. The need of special training and of laboratory work with students as well as with specimens, and the development of necessary research brought about the appointment throughout the country of trained men in physiology, pathology, bacteriology, anatomy, pharmacology and biochemistry. These men had regular academic standing and salaries whenever the medical schools were associated with universities. More and more schools either united with others or sought university connections. Medicine in a few decades went from a modified apprentice system through didactic lectures by members of the profession, who divided the curriculum among the Faculty, to a university status.

There was steady pressure to develop men in the fields of medicine and surgery who could parallel in training and in teaching those who were soon working upon the fundamental subjects of the medical course. The question of the full-time clinical professor was agitated, particularly following the report of the Carnegie Foundation for the Advancement of Teaching made by Abraham Flexner in the spring of 1910. This exhaustive report fitted right into what had been done by the Council on Education of the American Medical Association and attracted the attention of educators in this country and throughout the world. It can be considered the text of the drama of change in medical education.

The significance of scientific training in such a field as the care of the sick has been better understood with the passage of each year of the past fifty. Authority based on long years of practice was replaced by the facts of the laboratory and their inevitable

relationships to the welfare of patients. The plug-hatted doctor with his beard and long-tailed coat was soon replaced in the public eye by the white-coated surgeon with his rubber gloves. Medical faculties took on a different form. The scientist of the laboratory assumed a too predominant control of the medical curriculum. Only those of us who have lived through this whole fifty years and have seen these changes can grasp how striking they have been.

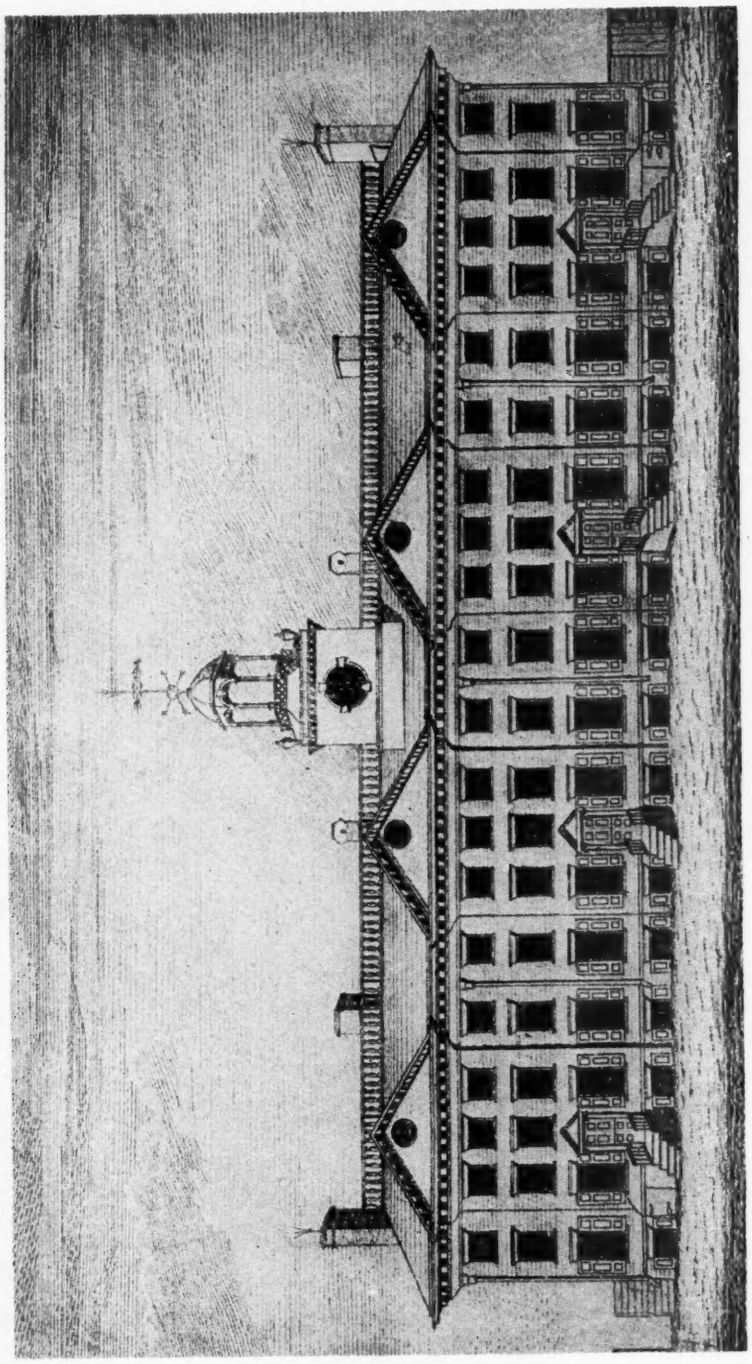
Along with the increase in laboratories, their personnel and costs came the rapid increase in hospital beds throughout the country. Not only did the hospital add the laboratory to its equipment but it also accepted much of the responsibility for the training of the various lieutenants of the doctor who are required in modern practice. The trained nurse, physiotherapist, dietician, radiologist, laboratory technician and social service worker all had to be prepared to join the physician, the medical student, the intern and the hospital resident at the bedside of the patient. The training of the candidate for his medical degree was but part of the educational projects taken over by the hospital and its staff.

We cannot separate the growth of our hospitals in number and size and their constantly rising position in medical care from medical education and the education of the public in the help that the modern physician can give. As they have become necessary for both the early and late training of the doctor, so have they become indispensable in offering facilities impossible to create in the home. These facilities are of value in the day-to-day training of the medical student, whose opportunities are almost inconceivably better than they were when he was an apprentice to a practicing physician.

It must always be remembered that the quality of the better medical student has not changed, and that the human body approached with skilled senses and a trained, active physician's mind will yield more clinical information than can ever be squeezed out by a piece of machinery, no matter how elaborate the machine or its surroundings may be. The main object of medical education for the last half century has been to train a worthwhile young person to accept with a fair chance of success the usual responsibilities facing a family physician. There have been many variations but the state examining boards have persistently kept this as their ideal in spite of the addition of new subjects and the lengthening of the preparatory and medical courses.

So rapid were the developments in the practice of medicine itself that it speedily branched off into specialties. One after another they flared on the medical horizon and for a while it seemed that the family physician of the past was doomed. The faculties of the medical schools were confronted with the difficult problem of how to fit in the training of the specialist with that of the general practitioner. There was a constant struggle within each medical faculty and between its members for the curriculum hours of the student to see that he had some experience and training in every field of medicine. In fact the curriculum became so engorged with old and new subjects, so mixed up with lectures, demonstrations, clinics and amphitheater operations, so tangled with legislative requirements, that the medical student was driven almost beyond endurance. The Association of American Medical Colleges, working with the Council on Medical Education of the American Medical Association, after many struggles brought about a more reasonable set of requirements. It was simply impossible to get all of medical lore into a crowded course of study and into a brain no matter how receptive.

The specialties have largely been pushed up into the hospital years and have become electives for medical students. Many a faculty has had to hold down a brilliant teaching specialist whose enthusiasm for his own subject made him lose sight of the need of a well rounded training for the young doctor.



COLUMBIA COLLEGE IN 1790

King's College Medical School occupied quarters in the above building 1767–1813

CONSTANT CHANGE

One thing that has been constant in all medical education in the last fifty years has been change. While there have been delay, conflict and mistakes, there has also been steady progress, at times almost whirl-wind in its effects.

Perhaps we can best understand what has taken place in the fifty years if we think of the present responsibilities of the young physician and of what he is expected to learn, compared with what was formerly available to the medical student in the ordinary American medical college and what those who called him in wanted in the way of service. The increase in the range of available facts is so much greater than then, that it is marvelous we are able to bring within our medical curriculum the essential knowledge that is tested in such examinations as those given by the National Board of Medical Examiners and by some of the State Boards. So basic are the fundamental requirements in science that we now take them for granted. So manifold are the different technical processes that the medical student must learn and so many are the procedures of the laboratory with which he must be familiar, that at times the emphasis seems to be taken off clinical work as such, and it seems as though we were trying to develop a laboratory specialist rather than a physician. Fortunately, in more recent years American medicine, while firmly based on the laboratory and its findings, has become more clinical in its emphasis. Since it is possible for a well trained physician to diagnose with the use of his own senses over 80 per cent of the ailments that are presented to him, it is clear that this reemphasis on clinical training is in the right direction. It was the development of clinical sense that made competent doctors out of the graduates of even the poorer commercial medical schools. What some of the men who were trained in these schools were able to accomplish in the way of leadership in every branch of medicine indicates that the practice of medicine is more an individual affair than something that can be acquired through industry alone, even under the best of conditions.

In viewing the present state of medical education it is important to realize that the size of buildings, the density of equipment and the number of hospital associations can not be used as indicators of the quality of instruction given a student. The one fundamental is a properly prepared student in the intimate presence of the patient under the guidance of a clinician. Medicine as an art is being forced upon us more and more as preventive measures limit frank disease and the reactions of the central nervous systems of patients to the floods of contacts to which they are exposed engross more of the attention of the physician.

One of the most disturbing facts in regard to medical training is that we have not succeeded up to date in giving all of our medical students an adequate understanding of psychologic processes and of psychiatry in general. In fact, the emphasis on the laboratory and its findings has been a distinct handicap in this respect. Certainly it is difficult to train medical students in the art of medicine; but unless there is a clear understanding on the part of medical faculties and of students that man is more than a bunch of reactions inside of a sensitive skin and that the personal equation is important in every patient, we are apt to continue to encourage the growth of more cults and isms. We must admit that side by side with the flowering of the science of medicine, with its astonishing services to man and society, there has been a steady development of cheap and flabby schools for osteopaths and chiropractors, and that the Chinese herbalist and the Eddyite flourish in the land. To appreciate the product of a great medical school is an acquired taste based on reason and understanding. For many the plausible doctor of magic gives greater emotional satisfactions than does the well trained doctor of medicine, even if these patients end prematurely in the cemetery.

The doctor, rather than the ordinary citizen, has been the creator of better conditions for medical education and practice, and has been the backer of protective legislation against unsound or inadequate training of those who care for the sick.

MENTAL DISEASES

There are more patients available in psychiatry in our hospitals than in almost any other branch of medicine, and less use is made of them than of any other hospital patients in medical education. Yet it is evident that these hospitals are to grow and that the percentage of patients with some form of mental disturbance is bound to increase. Mental conditions have been persistently neglected in American medical education. We must admit that we have lagged in our progress in this vast branch of medicine. Each year in each state the legislature is implored to provide more beds for the insane. The homes of our present cities must disgorge their addled members onto the hospital.

It is our American habit to seek quick relief, to be willing to be operated upon, but not to be willing to accept long and painful responsibilities in medical care. The doctors have fallen into these American ways and as a group psychiatry in all of its manifestations has passed them by. Our medical schools have for the most part been weak in this subject and in training in the physical measures that assist in treatment. Medical jurisprudence and social medicine have been sadly neglected at a time when the profession is being brought actively into nearly every part of our political, industrial and community life.

PUBLIC HEALTH AND PREVENTIVE MEDICINE

In fifty years, for all practical purposes, we have seen the birth and growth of public health and preventive medicine, with their profound effects on morbidity and mortality among our fellow human beings. Wherever the medical profession has been able to find some procedure, such as adding chlorine to drinking water, which would keep living organisms from getting into our bodies, preventive medicine has been an astounding success. Vaccination against smallpox could be universally successful; but whenever individuals have a choice as to whether they will or will not accept established preventive measures, we find a considerable percentage of failure. There is no denying the fact that in spite of the advances that have been made in every field of medicine we still have a large percentage of our population filled with prejudices and the easy prey of plausible persons without scientific understanding or training. Just how much of this can be blamed on our medical schools is hard to say; but certainly they have been slow to give prevention its place in every clinic, and the ordinary physician has been reluctant to absorb the responsibility of educating the public.

No medical course could be complete at the present time without training in the field of public health, and yet many of our medical schools deal with this subject in a perfunctory manner.

Somewhat anomalous it is that certain separate schools of Hygiene and Public Health have been established in this country before Public Health was made a department of consequence in every medical school. Only by special emphasis and financial support will public health take its proper place in the training for the degree of Doctor of Medicine.

RESEARCH

The study of each individual patient is a form of research. The doctor's life is devoted largely to performing such research or using the benefits that have come through the persistent research of others in every field of science. Every new discovery in science has been gone over by physicians in the hope that it could be applied to medicine. This has been the age of practical discoveries and of the development of the rays, beginning with the Roentgen rays. The

co-operation of the physicist, chemist and biologist has been sought everywhere by the physician.

Illustration of the vast influence of research in all medicine is everywhere to be seen and the medical school has done much to keep abreast of new discoveries.

Medical education has had to help develop personnel for such subjects as anatomy, physiology, pharmacology, bacteriology, pathology and biochemistry, and to use the information obtained from their work in the care of the sick.

In the medical faculty, research is possible only when there is sufficient over-staffing so that there is time to go beyond the routine of the day and routine teaching. This means increased costs. The greatest pride of the medical profession in this country is that it has been instrumental in bringing together large sums in the universities and in the special research laboratories which have made it possible to carry on advanced medical research in constantly increasing volume, much of it in the presence of the medical student. In fact, we have done as much medical research as the funds available for the purpose have permitted. Some medical schools have had greater success than others in securing gifts, but all of them have participated to some degree in exploring the unknown. It is easier now to secure funds for medical research than for medical education.

Every step that we have taken to advance the quality of medical instruction in the United States has resulted in greater costs. The cost per student is now higher in medicine than in any other part of our universities, but the social return is large if a good job is done. The medical profession has constantly sought to build up the funds of the teaching institutions. The sums obtained over five decades have been very large.

If we compare the medical schools of the last few years with those of thirty or forty years ago, we find that at that time the budget of the school was derived almost exclusively from student fees and that many of the proprietary schools profited either directly or indirectly from these fees. Now private endowments, or taxes for state supported institutions, provide over 60 per cent of the income of medical schools.

The qualifications of the faculty have changed from those of practicing physicians without special training dividing up the teaching of the subjects of the required medical curriculum, without facilities for research, to faculties with a considerable percentage of thoroughly trained individuals devoting themselves largely to teaching and research and receiving regular salaries. The voluntary clinical worker and teacher still carries a large part of the clinical and hospital care of patients and of the practical instruction of medical students.

Perhaps most significant of all has been the control of hospitals, either university hospitals or public hospitals, by the staffs of the medical schools. This bringing of the hospital directly into the medical school has played an essential part in making the laboratory and its findings effective in the care of the sick.

THE SPECIALIST

The past half century has seen the rise of the specialist. He was inevitable. Surgery made so many new demands both in training and the use of special procedures and technics that the surgeon early began to be distinguished from the physician. After the work of Lister and others the rapid growth of the specialist in surgery could not be avoided. It is a long stretch from the domain of the surgeon of the nineties to that of today. No part of the body is now inaccessible; but it has taken many subdivisions of surgery to bring this about. Gynecology had its period of rank growth. Obstetrics, while formerly almost a universal chore, is now an accepted specialty. Just as in an automobile plant one artisan spends his day in winding up one screw, so now in medicine some specialists only tear out tonsils or bore prostates. and others are allergists.

These refinements are too specific for the run of medical education. Certainly, the undergraduate medical curriculum has not had and will not have the time or the energy for training in more than the broad principles back of the more refined specialties. The development of postgraduate instruction, which for much of the last fifty years has been of a rather shabby and transient character, now has taken a form in several centers that gives promise for the development of selected men to as high a degree as is possible anywhere in the world.

The growth of special boards to give certification to those who complete an adequate course of training in one of these specialties is one of the more recent steps in advanced medical education.

EDUCATIONAL PLANT

The principal requirements of the commercial medical school of fifty years ago were lecture halls, a few microscopes and a dissecting room. Some sort of association with hospitals was also essential and outpatient clinics were the rule. If we compare the present plants of our three score and ten medical schools of today with the best of the old commercial institutions, we can more completely sense what has taken place.

The library of the medical school provides a reliable guide in its activities. The number of subscriptions to medical journals is an indicator which tells us just what kind of a medical school it is; for the larger the subscriptions to good journals and the greater their use the more effective the medical school. The growth of medical libraries in nearly every large center of population presages a great future for medical education.

A LOOK AHEAD

We must build the future on the past. These five decades had their foundations in centuries of devotion to the care of the sick by men of genius and by those of ordinary mind but with an extraordinary sense of service. We can look forward to the next half century confident that in our present scheme of medical education we have built into medical practice the best in science and have trained thousands of men and women who will correct the present inadequacies, fit into our changing civilization as we have done and always keep medicine in the forefront by applying their knowledge to human relief and happiness.

SURGICAL INTERNSHIPS OVER THE PAST FIFTY YEARS

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IN the year 1892, almost fifty years ago, a young physician received his degree from a midwestern university. His medical course had been completed in the usual three-year period, and like most of his classmates, he immediately entered practice in a small town in a neighboring state, without the advantage of an internship.

During his first year in practice, a patient was encountered who presented unmistakable signs of that new American discovery, appendicitis. Without skilled assistance or a competent anesthetist, and operating upon a patient on an improvised table in the home, this young man, with courage worthy of a McDowell, performed the first laparotomy ever done in that part of the country. Unfortunately, his daring was not rewarded with good fortune; for this turned out to be a case in which the operation was successful but the patient died. Feeling ran high in the little community, there were mutterings against this dangerous new method of doctoring and even threats of mob violence.

It was just before the Fourth of July, and in the annual parade down Main Street was a float on which stood two burly butchers wearing bloody aprons and holding up for the gaping crowds to see, a gory mass of sheep's intestines taken from the dummy figure of a patient stretched on a butcher's block. So intense was public feeling that the young, would-be surgeon was advised to leave town for the day, and he did so, taking his wife on an all-day picnic.

Gratifying to relate, the young doctor returned home late that evening and next day went on with his practice. Later, he had the hardihood to attempt further laparotomies which were attended with success. Eventually, he spent a year as a graduate student in Vienna and became a well qualified surgeon, according to the standards of his day. His life epitomizes, perhaps, the average educational preparation of a surgeon of fifty years ago in most parts of the country. Clinical clerkships had just been introduced at Johns Hopkins, internships were few and far between and residencies were in their infancy. Medical schools were yet to undergo the regeneration which followed the Carnegie Survey of 1910, and few hospitals indeed pretended to any form of organized education for their staffs. Americans were almost entirely dependent on European centers for graduate experience.

One sign of the weakness of medical school teaching of fifty years ago was the popularity of the organized "quizzes." These extracurricular exercises were presided over by outstanding young faculty members who were noted for their vigorous, almost slave-driving methods, as they hammered the multitudinous factual material of the course into their charges' heads. Certain of the quizzes, particularly in New York City, attained wide reputation. Besides their standing as aids in preparing for school and state board examinations, these quizzes also exercised the function of informal internship placement bureaus. There was keen competition between the various quizz masters to place their disciples in the few desirable hospitals then in existence. Their charges were coached with great assiduity, so that they might stand high in the competitive examinations given by these hospitals.

Among the quizzes, none was more famous than one of more than seventy students presided over by Dr. William S. Halsted. In collaboration with Dr. George

E. Monroe, he improved upon the traditional quizz sessions by giving his students practical exercises in the laboratory and at the bedside. Through all of his experiences, as an undergraduate, an intern and an attending staff member in New York, he had had ample opportunity to observe the development of students through their internships at the New York, Bellevue and Presbyterian Hospitals, and into their early years of practice. From these observations, he was convinced that the methods then in vogue of training young surgeons, first through a surgical internship and later through years of struggle in general practice, with the eventual emergence of a fortunate few as surgical specialists, was wasteful of educational resources and did not furnish the public with surgical service of sufficiently high quality.

In fact, he was convinced that a vicious circle had been set up. Hospitals, in order to attract the more promising candidates, sedulously cultivated the reputation of being very generous in giving a large number of operations to their house surgeons. In order to curry favor with their house staffs, the younger attending surgeons allowed their interns to do a great deal of operative work for which they were not adequately prepared. As it turned out, few house surgeons had sufficient opportunity to apply what technical skill they acquired during their early years in practice, and much of it was lost through disuse. Hence, a situation was created which in the long run was to work to the disadvantage of the intern, the young surgeon in training and the patient.

At this point, one of the romantic episodes of medical education occurred as an aftermath of a laboratory disaster. Dr. Halsted, during studies of peripheral nerve distribution, heard of a new local anesthetic drug. Obtaining a quantity, he carried out a series of injections of nerve trunks in his own body, systematically mapping out the resultant insensitive areas. Cushing has given Halsted the credit for being the pioneer in nerve block anesthesia. Unfortunately, it was not until Dr. Halsted was in the grip of cocaine craving that he became aware of its habit-forming properties. For a time it seemed as if his career was ruined, but devoted friends rallied to his aid and instituted measures to free him from his addiction. Among these friends was Dr. William H. Welch, then a young pathologist in New York who was instrumental in persuading him to throw in his lot with the infant medical school recently founded in Baltimore, Johns Hopkins. Dr. Halsted was appointed to the chair of surgery there on March 11, 1889.

Here was an event which was to alter profoundly the course of surgical education. Halsted was keenly aware of the defects of the system of surgical training in New York of which he had been an influential part and determined to avail himself fully of the opportunity presented at the Johns Hopkins Hospital to start de nouveau with an entirely new educational idea. The result was the long-range plan now famous as the Johns Hopkins residency system, in the development of which Osler, Kelly and Williams were active collaborators. The more promising of his students, after a year of straight internship, were allowed to enter a period of residency, extending over an indefinite period of years. Only one was carried through to the final position of chief resident, but the others were placed in clinics elsewhere to continue their training. Because of Halsted's extremely meticulous technic and consequent slower and more deliberate method of operating, many surgeons who visited his clinic came away with a prejudice against his methods. Also, because of Halsted's absorption in laboratory research, his residents tended to become dominant figures and seemed to cut unduly into the preserves of their immediate superiors on the attending staff. As a consequence, a resistance to the idea of residencies was built up in other centers, which it has taken almost fifty years to overcome. In fact, the conflict between the

old and the new still goes on in our midst, dissenters maintaining that the residency system narrows the young surgeon's interests too early. They feel he never can become a well rounded physician without a few years of experience in general practice. While there is much to be said for this point of view, the present trend is all in the other direction. The requirements of the American Board of Surgery and the American College of Surgeons make it increasingly difficult for the general practitioner to specialize by means of the old informal method of gradually narrowing the scope of his practice.

EVOLUTION OF SURGICAL INTERNSHIPS

For a clear understanding of the complicated picture presented by modern surgical internships, we must delve into their backgrounds. Only then do the reasons for the different arrangements which we call *straight*, *mixed* and *rotating* become apparent.

During the five decades since 1890, most of the history of the evolution of modern surgical internships has been written. Very little change had marked their course for the previous century since their introduction at the Pennsylvania, New York and Bellevue Hospitals as house surgeonships after the European pattern. At the Massachusetts General Hospital, the term, "house pupil," was used, and like so many good Boston customs has been preserved until the present day. Following the English system, practically all of these services were "straight," the preparation of the resident physicians in these early teaching hospitals being either for a medical or a surgical career. It must be remembered that the general hospitals during the nineteenth century consisted, in most instances, of only three services: surgery, medicine and obstetrics. At the old New York Hospital on lower Broadway, the house surgeon and the house physician alternated in the delivery of uncomplicated cases in the lying-in ward.

The idea of specialty services in other fields has largely grown up during the past fifty years. During that period pediatrics, neurology, psychiatry, neurosurgery, ophthalmology, otolaryngology, urology, orthopedics, obstetrics and gynecology and other specialties have grown to full stature. Many of them were housed in separate hospitals for eye and ear patients, the ruptured and crippled, the lying-in, the child and the insane. As a consequence, internships in the larger general hospitals were limited in scope, tending to remain "straight" at older institutions as the New York and Massachusetts General Hospitals, or "mixed" as at Bellevue, but ending as either house surgeon or house physician. So fixed were these patterns, based upon an appreciation of the value of prolonged exposure of an intern to one service, that they have persisted up to the present day. Without much question, the preservation of this ideal of prolonged training on one service paved the way for the development of the modern surgical residency.

Around 1890, however, the course of graduate education indicated by the experience of these early leaders in the field was almost submerged by a surge of hospital building, with a sharp rise in the curve depicting the numbers of hospitals, beds and interns in the country.* These newer hospitals, because of the demands of the various newly recognized medical and surgical specialties, were forced to set aside beds for the care of these problems, increasing the number of services from the basic three above mentioned to as many as fourteen.† Since it was not practicable, in the hospital of average size, to staff each service with a group of interns, it was inevitable that there would be a great increase of rotating internships to furnish the needed house staff coverage. Curiously, no standard form of rotation emerged,

* Internships and Residencies in New York City, p. 38, 1934–1937.

† Internships and Residencies in New York City, p. 163, 1934–1937.

except in states where it was fixed by law. During the recent New York survey, for example, out of sixty general hospitals inspected, no two of the rotating internship plans were identical. However, a considerable number gave their interns one or more periods of senior assignment which they called houseships. Carrying over the old tradition that the house surgeon should be allowed to perform major surgery under supervision, these senior rotating interns were permitted the same privilege. Aside from the objection to allowing one so inexperienced to practice on human material, even under close supervision, there were other more objectionable features. The chance to take scalpel in hand and perform a laparotomy came to be regarded as the final reward of the intern's labors. No matter how much he was exploited as a junior by an excess of routine duties, he could be kept contented if he could look forward to his share of appendectomies, herniotomies, hemorrhoidectomies and other operative procedures. Understandably, the number of operations "handed" to each house surgeon was a matter of wide comment among his mates on the hospital staff, and inevitably among prospective candidates for internship appointments. This overemphasis on technical surgery gave medical students a false idea of the place of surgery in practice, misled them as to the true educational value of the internship and encouraged too many practitioners without real aptitude or adequate experience to assume heavy responsibilities for which they were not prepared. Some of these men, of course, were fortunate enough to obtain adequate graduate training under preceptors in this country and abroad, and eventually emerged as thoroughly qualified surgeons; yet they remained a minority.

There are other factors responsible for the large number of general practitioner surgeons. The advancing frontier throughout the nineteenth century required doctors practicing in the new communities to deal with every case encountered, surgical or medical. Those of great natural ability did remarkable work, considering their preparation. Dr. William Wardell Mayo, the father of Dr. Charles and Dr. William Mayo, a general practitioner in Le Sueur, Minnesota, first came into prominence as a skillful surgeon in connection with his care of the victims of the Sioux Indian outbreak of 1862, and later after a tornado which wrecked the town of Rochester, Minnesota. In most instances, men of this type in their earlier years were without adequate hospital resources, and the surgeon's success was dependent on his ability to improvise an operating room in the patient's home. We must not forget that the laboratory examinations which are now an accepted part of a complete diagnostic study, together with the requirements incidental to modern aseptic surgery, hardly made their influence felt before 1890.

The twenty-year period from 1890 to 1910 was characterized chiefly by a rapid increase in the number of medical schools, students, hospitals and interns. Actually, the growth of the hospitals failed to keep pace with the multiplication of schools, for in 1904 the *Journal of the American Medical Association* reported that there were internships for less than half of the medical graduates and that few of these were of good educational standing.

In 1914, the American Medical Association began to issue its annual compilation of internships, but it was not until 1920 that the hospitals caught up with the procession and provided enough internships to make this experience available to all graduates. Consequently, it has been only during the past twenty years that practically all medical students have been assured of at least one year of hospital training before entering practice. During so recent a period have occurred practically all of the dramatic alterations which have so completely changed the complexion of modern surgical internships. In the face of a rapidly increasing number of residencies, they have had to revise their function markedly. The house surgeonship promises

to become largely a vestige, and the surgical internship merely an introductory period of training in diagnosis and methods peculiar to a surgical service. Some hospitals have gone so far as to abolish the surgical internship entirely, transferring its functions to the assistant residency and residency, but requiring a previous general medical internship as a groundwork. It seems likely that some form of surgical internship will survive, probably of mixed type such as a year consisting of six months each of medicine and surgery, which may serve as a foundation not only for advanced training in surgery, but in medicine, pediatrics, any of the various specialties or for any of the additional types of preparation needed for general practice.

As to the number of surgical internships annually available over the past fifty years, the recorded statistics give very little reliable information. Only within the past decade have the internships listed in the Educational Number of the *Journal of the American Medical Association* been differentiated as to whether they are rotating, mixed or straight. An examination of the straight internships offered over the last five years appears to indicate that those of surgical type have remained at a more or less constant level.

When the data as to surgical residencies is examined, however, there is quite a different story. In 1935, 145 hospitals reported a total of 449 surgical residencies of all types; while in 1940, 230 hospitals listed a total of 788 residencies, assistant residencies and surgical fellowships, or a gain of more than 87 per cent. These figures are, of course, exclusive of residencies listed in other surgical fields, such as gynecology and obstetrics, ophthalmology, otolaryngology, orthopedics, urology, malignant disease, neurosurgery, and plastic, thoracic and traumatic surgery.

The future of surgical internships will depend entirely on events still in the making. We must not forget that the first list of surgical residencies was not issued until thirteen years ago. Only within the past five years has the American Board of Surgery come into being, and has the American College of Surgeons attempted to classify acceptable residencies. In the face of a world at war, no one can accurately predict what tasks our profession and its hospitals will be asked to assume.

Someone has called the World War II a war of miscalculation. So far, we Americans have an opportunity to size up the situation, plan thoughtfully and efficiently, and learn from the mistakes of others. In the job of utilizing our clinical resources wisely to supply an adequate number of doctors to meet the needs of the country, there is no task more pressing than that of adjusting surgical internships and residencies, so that resources available for teaching may be wisely and efficiently used.

SURGICAL OPERATIONS FIFTY YEARS AGO

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IN accepting the invitation to contribute my personal experience on "Surgical Operations Performed Fifty Years Ago" for the semicentennial number of the American Journal of Surgery, it occurred to me that the most effective introduction to the subject would be to reproduce the image of a representative American surgeon operating in a surgical clinic typical of the American scene of fifty years ago, just about the time when the Listerian revolution was beginning to assert itself in this country.

The *Journal* has been most happy in selecting as a fitting frontispiece to its semicentennial issue an artistic reproduction of the now famous painting by Thomas Eakins (1844 to 1916) which so faithfully and admirably depicts the fine, intellectual and kindly personality of Dr. D. Hayes Agnew, one of the ablest and most honored master surgeons of the past generation, who is seen holding one of his celebrated clinics at the Pennsylvania Hospital in Philadelphia, in 1889.[1]

[1] This portrait is now at the Wistar and Horner Museum of the University of Pennsylvania. It was presented at the annual commencement of the Medical School at the University, on May 1, 1889, by the undergraduate classes in honor of Professor Agnew on the eve of his retirement from active teaching. Dr. Agnew is shown leaning on the low railing of the amphitheatre in an easy posture, having just completed an excision of the breast for cancer, still holding the scalpel in his left hand (he was ambidextrous). All the figures were taken from life, including that of his successor, J. Wm. White, his first assistant. The painting is justly regarded as one of the masterpieces of Thomas Eakins, that famous artist who made a specialty of medical subjects.

In the treatment of this subject, the painting is an amplification of the portrait of Dr. Samuel D. Gross, done by the same artist. The picture incidentally shows an interesting change in surgery, the white garments of Dr. Agnew and his assistants being an innovation, due to antiseptic surgery, unknown in Gross' time.

The following is the inscription on the frame: "D. Hayes Agnew, M.D., chirurgus expertissimus; scriptor et doctor clarissimus; vir veneratus et carissimus," which, being translated, reads: "The most experienced surgeon, the clearest writer and teacher, the man most beloved and venerated." (J. Howe Adams. "Life of Agnew," p. 333. Philadelphia, 1892. Davis & Co.)

To those of us who have lived and participated in the surgical life of the pre-Listerian period, this portrait of Agnew and his clinic has a special appeal as it reproduces with absolute fidelity the dawn of the new surgery as it was beginning to appear above the horizon in every one of the leading hospitals and surgical centers of America and throughout the world.

RECOLLECTIONS OF A PRE-LISTERIAN INTERNSHIP

Since I am expected to give some account of personal impressions and experiences, I trust I may be excused for speaking in the first person, as I might as well begin with the earliest recollections of my medical career which began as a matriculate of the Medical School of the University of Louisiana (now Tulane), in the fall of 1877, and as an intern of the Charity Hospital of New Orleans from 1878 to 1880, when I was graduated as an M.D.

Thanks to the opportunities given me by my internship, I had ample occasion to acquaint myself with the operations and methods of wound treatment which were in vogue at the hospital at a time when Pasteur's discoveries and Lister's application of them to surgery were still in doubt and dispute, despite the fact that Lister had enunciated the principles of the antiseptic doctrine in 1867, and had continued to accumulate evidence in its favor during the ten intervening years (1867 to 1877).

Let us remember that in 1878 to 1880 the belief in spontaneous generation was not yet dead. Many people in the world still held it with all the ancient Aristotelian credulity, and many listened with sympathy to the prejudiced and specious

arguments of Pouchet and Colin at the French Academy, of Bastian in England, and Liebig in Germany, long after Pasteur had delivered the deathblow to this belief, a whole decade before, when he irrefutably demonstrated its fallacy and failure as a scientific explanation of fermentation and putrefaction. And so it was that in medicine and surgery very slow progress was made in learning how to use the words "infection" and "sepsis" in a Pasteurian and Listerian sense, that is, as synonymous with bacterial invasion, a living contagion, a transmissible, inoculable and multipliable entity amenable to all the laws that govern animate things—the *contagium vivum et animatum*—the microbe.

This does not mean that the words "infection" and "sepsis" in relation to wounds were new or unknown before the antiseptic age. The word "sepsis" had been in use since the beginning of the eighteenth century, and "antiseptic" substances had been recognized from time immemorial to designate chemical agents that were opposed to putrefaction. The pharmacopeia was indeed rich in these substances long before Lister, who, basing himself on the researches of Lemaire and Calvert, had brought carbolic acid into prominence as the chief representative of the antiseptic group.

Thus it was that during the course of my internship at the Charity Hospital we, of the staff, were quite familiar with the corrective properties of chlorinated soda, better known as Labarraque's solution, and other chlorine derivatives which played so conspicuous a part in the Carrel and Dakin treatment of wound infections during the first World War. Iodine in alcoholic or aqueous solution, potassium permanganate, the coaltar solution popularly known as Goudron Bobeuf, zinc chloride, Peruvian balsam, Friar's balsam (tincture of benzoin compound), alcohol, spirits of camphor, glycerin, tincture of arnica, nitrate of silver, turpentine, calomel powder, yellow bichloride wash, black calomel wash, iodoform, and innumerable other aromatic alcoholic tinctures including aromatic wine, "vin aromatique" of the French Codex, played an important rôle in the "mundification" (disinfection) and deodorization of wounds and infected areas, long before their value as germicides entered into the calculations of their prescribers. Nor were the ubiquitous hot flaxseed poultices forgotten as the ever faithful arm of our fathers in days of purulent trouble. But carbolic acid held the spotlight in the antiseptic scenario until the early nineties, when it was temporarily dethroned by the introduction of the bichloride of mercury (corrosive sublimate). This had been shown in the laboratories of Robert Koch, in Berlin, to be infinitely more germicidal by the tests of the laboratory. However, after causing very considerable mischief the corrosive sublimate failed to hold its supremacy in the clinic by the loss of bactericidal efficiency in the presence of coagulable serum and in the purulent secretions of the wounds, despite the efforts of Dr. E. Laplace, of our staff, and a pupil of Koch, in New Orleans, to maintain its laboratory efficiency by the addition of tartaric acid to the sublimate solutions. Fortunately for the hands of the surgeons, the personnel of the operating room and the skin and tissues of the patients, the need of this most irritating, toxic and discoloring agent ceased with the advent of heat sterilization and the rubber gloves or "boiled hand."

In the transition between the old septic and the new antiseptic period there were many modes of treating wounds, almost as many as there were senior surgeons on the staff. These variations were most notable in the treatment of compound fractures, lacerated and incised wounds and especially amputations, which were the most frequent major performances at a time when the field of surgery was much restricted in its indications and limitations (1877 to 1880).

Notwithstanding the seeming indifference or reluctance to adopt the typical Listerian dressing, there were certain prominent features of the antiseptic ritual which found general acceptance, even when the

doctrine itself was subject to doubt and criticism. These were:

(1) The use of carbolic acid as the preferred antiseptic.

(2) The revival of drainage with Chassaignac's rubber tube in wounds and in closed amputations, leaving the stumps open and unclosed.

(3) The gradual adoption of the buried, short cut, carbolated ligatures, preferably Lister's catgut or silk. But even this marvelous improvement in technic was slow in coming, for, in 1878 and 1879, I saw a number of amputation stumps from which long ligatures dangled, waiting to ripen in pus to drop off.

(4) At an amputation it was the most frequent practice to irrigate the wound with a 5 per cent carbolic solution, then insert the rubber drains and suture the flaps, leaving large intervals between the sutures, after which adhesive strips were applied to support the whole stump, while compressing with gentle pressure to avoid dead spaces.

(5) The stump and limb were wrapped in cotton batting (later sterilized absorbent cotton was used) and bandaged with the wide heavy cotton or linen rollers of that period.

While this mode of treatment gradually became part of the routine management, the procedure was something of a compromise with the early Listerian ritual in which many of the minor features were missing. It was virtually the same dressing which Lister himself had modified from Syme, his father-in-law, in Edinburgh, long before Lister had arrived at the conclusion that infection was the assault of a bacterial invasion.

As relics of the pre-antiseptic period, various methods of dressing and treating stumps were still in evidence before 1880. These varied considerably, according to the school in which the surgeons had been trained. The surgeons who were graduates of American schools were largely inspired by the American texts of Ashurst, Gross, Hamilton and Agnew, with a fundamental leaning toward British traditions (Astley Cooper, Erichsen, Bell, Paget, etc.). Those of French origin still held allegiance to the great Parisian masters, Dupuytren, Velpeau, Lisfranc, Broca, Nelaton; while the few Germans swore by Von Graefe, Langenbeck, Volkmann and Billroth.

As a result of this international medley, a number of methods were devised to protect the amputations from infection or to combat it when it occurred. These procedures if catalogued would embrace over twenty to twenty-five designated titles, and can be generally classed under two heads:

A. Methods which aimed at a free contact of the open stump with the air, with or without approximation of the flaps, kept wet or dry according to the circumstances. The open or dry methods were advocated in Britain by Teale, of Leeds, Humphrey, of Oxford, Stimpson, of Edinburgh (1860), and with some modifications by Volkmann, Thiersch, Nussbaum and Billroth (1855 to 1876) before their conversion to Listerism.

(1) A typical dressing of the *open dry type* was that practised systematically by Dr. James R. Wood, of New York, which is graphically described by Dr. Frederick Denis, his devoted intern (1876):

"After the limb has been amputated, the flaps are not even coaptated, but left entirely open. A pillow of oakum is placed under the stump, which is allowed to rest upon this support until the wound is nearly healed. A small piece of gauze is placed over the contour of the stump and a cradle over the limb, so as to avoid contact with the clothing. This is all the dressing that is employed; no sutures are used except in lateral skin flap methods, no adhesive plaster, no oil silk, no bandage. No dry charpie is stuffed into the wound, no fenestrated compresses are placed between the flaps; in other words, the stump is left entirely alone, naked, just as the surgeon made it in his amputation. . . . As the wound drains freely, it is irrigated at frequent intervals with carbolic solution, after which Balsam of Peru (which makes a fine stimulating application) is poured over the granulating surface. When suppuration has subsided the flaps are gradually approximated by strips of adhesive plaster."

(2) In the *wet division* of the open methods, the most prominent was the "cold water dressing" of Robert Liston, used in bad septic cases as late as 1885 and later. This consisted in holding the stump on a rubber covered pillow, keeping it constantly wet by a drip of cold water, (plain or medicated) falling on a thin gauze cloth from an overhanging receptacle, the water draining by a gutter to a bucket on the floor.

(3) In this group also was the "*simple open wet dressing*" *of Prof. John Asburst*, of Philadelphia (1870 to 1885), in which the sutured stump was drained with rubber tubing and kept wet by loose surface dressings *soaked in laudanum*, substituting this by alcohol at the end of forty-eight hours.

(4) An extension of the *open wet method* was that advocated by Langenbeck, in Germany, Lefort and Verneuil, in France, and Hamilton, in New York, which consisted in keeping the patient himself immersed, with his open undressed stump, in a tub with flowing plain or medicated water. This was carried out on the same principle as the Hebra continued tub baths utilized to this day in the Austrian and German dermatological clinics.

B. Methods which aimed at the total *exclusion of air* from the stump, under the impression or belief that the infection, whatever it was, was transmitted through the air,[1] in manifest contradiction to the principles held by advocates of Class A.

(1) Perhaps the most typical of these was the method to be described later, the "*pansement ouaté*" of Alphonse Guerin, with which I was most familiar, as I had seen it applied at the Charity Hospital.

(2) Other methods which were remarkable because of the devices used to exclude air from the stump were: the "pneumatic occlusion" of Jules Guerin (1865); the "incubation method" of Jules Guyot; the "pneumatic aspiration" method of Maisonneuve, which aimed at the constant aspiration of air and secretions; the dry closed covered dressing, with drainage, practised by Syme and Lister before Pasteur's discoveries (1850 to 1860).

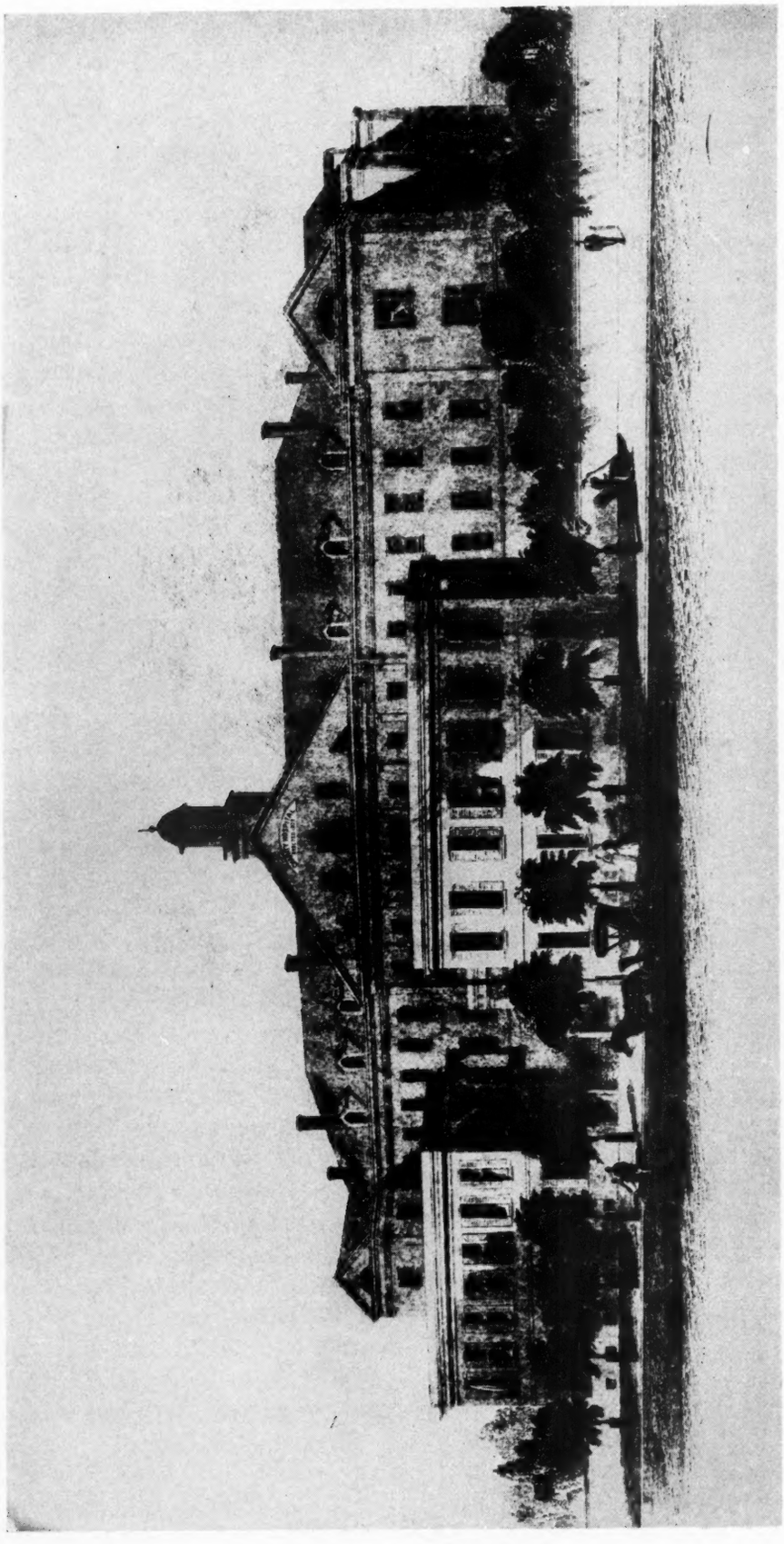
(3) Among others were the "Bordeaux method," a compromise between the Guerin and Lister methods (1864); the "earth pack" dressing of Addinell Hewson, of Philadelphia (1872); the coagulating "perchloride of iron dressing" of the open stump of Bourgade, of Clermont Ferrand, France, which created with the perchloride a "tough leathery cuirass of necrotic tissue which completely isolated the subjacent tissues from the influence of the contaminating air and other surrounding agents. This mass was detached slowly after the sixth or tenth day, and in becoming detached, left a surface covered with healthy granulations. The wound was then dressed with aromatic wine and the flaps brought together to induce union by second intention."

This multitude of dressings and their variants, of which the titles just referred to are only samples, and in which the advocate of each mode deplored the great mortality of amputations in the hands of other surgeons and confidently put forward his own method as superior, which, by his own experience, he had proved best—showed by the complexity of methods and their contradictory principles and ideas—how, in ignorance of the essential causative factor of infection, the surgeons of the pre-antiseptic period, in despair at the fearful and prohibitive mortality of their operations, sought frantically anywhere and everywhere, for some mode of relief.

ALPHONSE GUERIN AND THE "PANSEMENT OUATÉ"

Of these international and pre-Listerian methods, I was most impressed by the

[1] The notion of protecting a wound from infection by excluding atmospheric air is an old one. The germ of the idea is found in a treatise on wounds by Cesar Magatus, a Franciscan monk and professor at Ferrara, who lived from 1579 to 1647, but the first practical application of the method in modern times is attributable to Chassaignac, who, in connection with his system of tubular drainage (1858) recommended that the wound be closely covered with strips of plaster in order to exclude it completely from the air. (Ashurst. International Encyclopedia, vol. 1, p. 595, 1881.)



The Original Charity Hospital of Louisiana, at New Orleans

closed method of treating amputation stumps, which had been introduced by Dr. Yves Lemonnier, a distinguished Louisianian of French descent, who, on returning from Paris in the early seventies had brought with him, and applied for the first time, the closed, cotton-pack dressing of amputation stumps known in France as the "*pansement ouaté*" of Alphonse Guerin and which we, the interns, designated as "Lemonnier's cotton bale dressing." Though Guerin and his "*pansement ouaté*" have long since been forgotten, even by the few men who have survived the period of our internship, I feel justified in lingering over it as an episode of particular significance as a precursor of Listerian practice, as well as on my own account because of my vivid recollections of the genial surgeon who sponsored it and of the benefits that seemed to accrue from the application of this method, despite the paradox of its very disagreeable olfactory offensiveness. The memory of this dressing has also been very sharply revived by its analogies to the closed plaster of Paris method of J. Winnett Orr, of Lincoln, Nebraska, applied by Trueta and the Spanish surgeons on the Catalonian war front in the late civil war in Spain.

Guerin believed that septic infection in wounds was caused by contact with the atmospheric air, which brought to the wound an air-borne but unknown poison or miasm which, possibly acting as a ferment, caused inflammation and suppuration. He believed that if air could be excluded from a surgical wound, as in an amputation, septic infection would be avoided. He justified his view by comparing the benign behavior of a simple fracture in which the air was excluded from the seat of injury, and the disasters of compound fracture, also the effect of opening cold abscesses which were painless and apyretic as long as air was not allowed to enter the abscess cavity; and he also pointed to the comparative innocuousness of the subcutaneous operations of tenotomy in orthopedic surgery, with the formidable consequences of the open section of the same tendons and fascia. Therefore, he advocated the making of valvular incisions in draining pleural effusions and fluid collections in joints, which allowed drainage without admitting air into the cavity; also in doing subcutaneous osteotomy for bone deformities, etc.

Proceeding with this idea of preventing infection by the exclusion of air, he devised his subsequently famous cotton pack dressing which he used to special advantage in the treatment of amputation stumps of the lower extremity. After the amputation, preferably of the circular type, he made no attempt to approximate the flaps, but packed the whole wound with raw cotton wool so that the secretions could soak into the pack without impediment. After firmly packing the cavity of the stump or the space between the flaps, the stump and the entire limb was immobilized by enveloping it in a huge cotton wrap or covering made by many successive layers of cotton batting, all bound and held snugly together by wide and immobilizing bandages. This dressing, once applied, was not disturbed at least for two or three weeks. In the meantime, the discharges slowly permeated the dressings and became extremely foul and offensive, so that by the time they were removed they had become an intolerable nuisance.[1] Strange to say, when the dressings were removed and the great magma of pus and other decomposing material had been washed off, the raw surfaces of the stump presented a rosy, granular, and seemingly perfectly healthy appearance. Healing had progressed in a perfectly normal course despite the abundance of pus and saprophytic emanations. Under these conditions, the flaps were then brought together and held in contact with adhesive

[1] It was this most disagreeable feature that made the Guerin dressing highly unpopular and restricted its use in the wards of its chief advocate (Dr. Lemonnier) who seemed to gloat with satisfaction at the discomfiture of his critics whenever they came to him with complaints about the odor of his patients, pointing to their comfort and feverlessness and their healthy, painless and healing wounds, when their dressings were changed and the secretions were washed away.

strips or interrupted sutures until complete union and cicatrization had taken place, the stump being again immobilized in a copious cotton dressing, which was cheaper and more available in Louisiana than in any other part of the world. The most notable feature of this cure was that, despite its stench and offensiveness after the dressing had been on for over two or three weeks, the patient recovered without any of the usual local and systemic complications of rival methods.

The reasons for the success of this method according to the author were: (1) that it kept away atmospheric contamination during the process of healing; (2) it allowed free drainage; (3) it kept the wound free from irritating washes and disturbing manipulations; and (4) it kept the amputated limb at rest while healing was going on. And that is precisely the experience that was renewed by the Spanish surgeons during the late civil war by the practice of the *closed plaster of Paris method*, in dealing with compound fractures and septic war wounds, which, despite its offensiveness, has yielded such surprisingly favorable results.

As the story of Alphonse Guerin and his method has some distinct bearings on the mode of treatment that preceded the adoption of the Listerian principles, it will not be inappropriate to make some reference to his personal career and to the fate of his method. Guerin was born at Ploermel, in Brittany, in 1816, and died in 1894, at the age of 78. He was elected surgeon to the hospitals of Paris in 1850. Three years previously he had advanced his theory of wound sepsis as dependent wholly upon "miasmatic" contamination of unknown origin through the atmosphere. In 1871, he first applied the occlusive dressing to amputations, which bore his name. In 1872, the members of the French national society of surgery were dumbfounded when he reported that out of thirty-four thigh amputations, nineteen had been saved by his method.

At that time septic infection in amputations, at the thigh, was regarded as almost inevitably fatal, and the military experience of the surgeons of the Franco-Prussian War (1870 to 1871) only too tragically confirmed this fatalistic prognosis. The postoperative mortality during that war was so frightful that the ablest surgeons in Paris felt compelled to close their wards. Trelat definitely quit all his work at the St. Louis Hospital after losing practically all his wounded. Gosselin, Verneuil and Nelaton, likewise dismayed by their mortality, hurriedly gave up their services. And the same thing happened in Germany, where Volkmann, Nussbaum, Thiersch and others had to stop operating for the same reason that prevailed in France and in other countries. It was during these tragic hours, when death seemed to stalk in the footsteps of the surgeon as if to complete the deadliness of warfare, that Alphonse Guerin came unexpectedly on the scene with his strange dressing, to bring hope and confidence to his disheartened colleagues.

It was about this time, during the siege of Paris (1870 to 1871), that Nelaton, at the Grand Hotel, which had been converted into a hospital, in despair at the seeming failure of surgery to stem the tide of infection and disaster, declared that "whoever triumphs over purulent or septic infection deserved a statue of solid gold."

While Guerin's simple "cotton bale dressing" was not based on a clear or demonstrable scientific principle apart from its definite aim at the exclusion of aerial contamination, its practical application constituted a real advance. It is not surprising, therefore, that for two years after the Franco-Prussian War Guerin enjoyed a just reputation as master of surgery in Paris, and that his office became the *rendezvous* for a continuous parade of students and surgeons who came to observe and learn from him a mode of treatment which, despite its serious defects, proved superior to all others. The reputation of Guerin, like that of Nelaton,[1] his con-

[1] Nelaton's fame had spread especially in France and Italy because of the porcelain probe that bears his name. With his porcelain probe, devised for the purpose, he had discovered the long hidden bullet in Garibaldi's leg, at a time when a number of eminent surgeons had

temporary, had travelled a long way beyond the national boundaries, but by a different route.

Besides his skill, he was quick and quite witty, as is shown by the following anecdotes told of him. On one occasion Guerin was called to Rome to attend Pope Pius IX, who was suffering from an ulcer of the leg, which he cured when other eminent surgeons who had preceded him had failed. The Pope in thanking him said that, in his opinion, he, Guerin, was "the greatest surgeon in the world," to which Guerin replied, "I bow in thankfulness to the judgment of your Holiness, which I accept unquestioningly, since it is infallible." On another occasion, after the great surgeon had auscultated the chest of the supreme pontiff, he said, "I shall be very careful, your Holiness, when I return to France, to let no one know that my hand has rested on your breast, for if I did, they would soon cut off my ears to make relics of them." (Fourmestraux.)

MORITZ SCHUPPERT—PIONEER IN ANTISEPTIC SURGERY IN AMERICA

When Lister came to the United States in 1876, to preside at the International Medical Congress held in connection with the Centennial Exposition at Philadelphia, which was ten years after his first pronouncement of the antiseptic doctrine, he was no doubt disappointed at the indifferent impression that his teachings had produced in the United States. This was even more remarkable in view of the much closer relations of the United States to England than any other country and that the Germans, whose clinics were much frequented by admiring Americans, had adopted Listerism with great enthusiasm.

The reasons why American surgeons had been so slow in subscribing to the Listerian doctrine were well stated by Professor Robert F. Weir who, writing in 1877 (N. Y. Med. J., December, 1877, January, 1878) stated: "It is only lately that in America attention has been given practically to the teachings of Lister in respect to the treatment of wounds. In fact, aside from an article by Schuppert in the New Orleans Med. & Surg. J., little or nothing has appeared in our medical journals relative to the result of the so-called antiseptic method." The reasons given by Weir to account for the tardiness of American surgeons to try this mode of treatment were: (1) that the treatment, as enunciated by Mr. Lister "has been repeatedly changed in its details; (2) that it was too complicated and demanded the supervision of the surgeon himself, or, in a hospital of a carefully trained staff of assistants; (3) that many who had tried it had been unsuccessful in the cases where the essay had been made; (4) but the most weighty objection which was asserted or entertained was the positiveness of the enunciation of the germ-theory in explanation of the process of decomposition in the secretions of a wound." While this was true, there was still another reason which Dr. Weir did not mention and that was the indifference, the hostility of some of the leading British surgeons, themselves, who sought to minimize the importance of the Listerian movement at home (Nunnelly, Savory, Paget, Wood, Humphrey, Spence, Callender, Bantock, and above all, Tait). But this opposition was offset later by the loyalty of Lister's pupils and associates and by the enthusiasm of the Germans, French and all the leading surgeons of the continental European countries, who ultimately recognized the merit of his labors and accorded him the homage due to one of the world's greatest benefactors.

In New Orleans (1877 to 1880) as previously stated, the faculty and the staff of the Hospital, in common with all the leading surgeons of the United States, were undecided, skeptic or frankly hostile to the method, the only exception being a German surgeon, Dr. Moritz Schuppert, graduate of the University of Marburg (1849) where he was born in 1817, who championed the cause in New Orleans. He had settled in New Orleans in the early fifties, soon rising to dis-

failed to demonstrate its presence. Of course this was long before the age of Roentgen and the *x*-rays.

tinction as a very able operator and prolific writer, despite the short time he had to acquire a knowledge of the language. He was soon a member of the Hospital Staff, a professor in the Charity Hospital Medical School and prominent at medical meetings. Always a diligent student and omnivorous reader, he kept in touch with German literature, and it was from this source that he gathered the enthusiasm of his old friends and teachers in acclaiming the new era that had dawned in surgery with the advent of Lister and the antiseptic doctrine. In a lecture published in the New Orleans Med. & Surg. J. for January, 1878, Schuppert stated: "The astonishing reports which had reached me from the interior of Germany at the end of 1874, that the antiseptic treatment of wounds recommended by Lister promised to cause a revolution in surgical practice, did not permit me to rest, and the Spring of 1875 found me already on the road to visit those places where such stunning facts were reported. After my return to this city in the fall of 1875, I gave a resume of what I had absorbed in some of the most renowned hospitals of the European continent in a few lectures delivered in the amphitheatre of the Charity Hospital and reported in this Journal."

In this extensive monograph, Schuppert gives a most minute description of the antiseptic treatment, the progress it had made, especially in Germany under the leadership of Volkmann, whom he admired intensely and followed most closely; and he closes finally with a complete summary of his own experience based on his personal operations in New Orleans at the Charity Hospital in strict pursuance of the Listerian method during the period 1875 to 1878.

His summary embraces 120 miscellaneous operations including twenty-three amputations (major and minor), seventeen resections of bones and joints, two compound comminuted fractures of leg and thigh, five ligations of arteries in continuity, thirty-four cuts and stabs including larynx and pharynx, stab of chest, two gunshot wounds of abdomen (one death), three penetrating stabs of abdomen with no deaths, altogether 120 operations, besides forty-four chronic ulcers of the leg, treated antiseptically, with a total mortality of only 4 per cent.

He describes in minute detail the antiseptic treatment in the complicated and methodical ritual-like form of the early Listerian dressings, but modified and simplified by Volkmann and later by himself after his return to New Orleans. These details I learned personally under very impressive circumstances when it was my fortune to be called, as interne, to carry out the full program of antiseptic preparation for the extirpation of an enormous ovarian cyst in a patient admitted in the summer of 1878. The chief of my service, Dr. Wm. Carson, called on Dr. Schuppert to direct and assist him in the prospective ovariotomy which was to be the first performed in the Hospital under strict antiseptic precautions. This occasion gave me an opportunity to become acquainted with that remarkable veteran of surgery and his two sons, William and Charles, both graduates of medicine, who assisted him, particularly William, the eldest, who had recently arrived from Vienna after two years of study in the surgical clinics of that great and flourishing center of medical culture.

A COMPLICATED OVARIOTOMY UNDER THE SPRAY

The patient, a white woman of 55 years, presented a huge ovarian cyst of the gigantic size now never seen, but common enough then, when tumors grew unmolested in patients living in the rural districts, like the trees of a primeval forest which has never known the aggression of the sawyer or of the lumber jack. The patient had been tapped many times and the effects of these tappings were secondary peritoneal reactions followed by general adhesions which completely immobilized the sac. Besides, the tumor was so large that the patient, who was small, thin, and worn by pro-

longed suffering, seemed to have grown to the tumor rather than the tumor to her. "A very unpromising case" as Dr. Carson and Dr. Schuppert remarked. Under Schuppert's instructions, the patient was kept in bed and given the benefit of all the preliminary examinations and dietetic and hygienic care to fit her as much as possible for the operation. Miserable and discouraged, she begged to have something done regardless of consequences. Accordingly, a small operating room was chosen, away from the main theatre to avoid dust and an overcrowded audience. The night preceding the operation, the floors were scrubbed and covered over with sheets rinsed in a 5 per cent carbolic acid solution and the walls were also covered with sheets rinsed in the same solution. The tables for instruments and accessories were all draped in the same freshly laundered sheets which had been wrung out in the carbolic solution, the gowns of operators, assistants and nurses alone were exempt from the acid bath. The instruments, previously well scrubbed, were kept immersed in a 5 per cent carbolic solution. Large "elephant ear" marine sponges were kept immersed in the carbolic solution, ready for use in the abdomen.

The wash room was furnished with soap, brushes and a 5 per cent carbolic solution for hand scrubbing and disinfection. There were no caps, no masks, no gloves, as these were unknown at that time (1878). The abdominal surface was prepared in the usual way by applying a thin poultice of green soap, to be followed by a thorough wash of the softened skin with a 5 per cent carbolic water solution, leaving a thin towel wrung out of alcohol over the abdomen until the start of the incision. The drapery of the patient was all freshly laundried.

A hypodermic of morphia was given twenty minutes before the operation and the anesthesia started with chloroform dropped over an open cone. The anesthetist was an undergraduate intern, as it was the custom to give the residents practical experience.

Finally, a large steam atomizer was started to keep a steady spray of a 5 per cent carbolic solution continuously over the operating field.[1]

Schuppert often spoke of substituting thymol for carbolic acid as this was being done by Volkmann at Halle with satisfactory results, or salicylic acid which Thiersch was then trying at Liepzig. Neither of these was available at the Hospital and the classical carbolic solutions were used.

Finally, the moment for the operation had come but, despite the efforts to reduce the number of spectators they continued to squeeze in, always getting nearer the operating table in their street clothes without any overgown or other pretense of a cover to reduce the risk of contaminating the room, depending only on the spray to shield the field of the operation from air infection. As it was a hot summer day, the combined effect of the spray and the overcrowding of the small room, caused the perspiration to start freely on the forehead of the operator (Dr. C.) and his first assistant, Dr. William S., while the senior Dr. Schuppert, as director and counsellor, sat on a stool by the side of the patient with the operating field in excellent view. A nurse was kept busy from the start with a cold wet towel to wipe the perspiration which was streaming from the heads of the operators. There were then no electric fans, no air conditioning apparatus such as now makes operating more comfortable and even enjoyable, only palmetto fans which were forbidden for obvious reasons. The recollection of that hot, stuffy room under the sky lights on a bright summer day makes me realize the enormous advantage and comfort of modern air conditioned operating rooms, with no spectators in the way, and the powerful shadowless electric lights which make the skylights, and the placing of operating rooms on the top floors of the buildings, absolutely unnecessary.

[1] While these preparations were going on, my clothing became so permeated with the odor of carbolic acid that my classmates used to tease me by calling me Lister—"Mr. Lister, when will you serve that carbol lemonade?"

Going back to the operation and the anxious operators, the pathology in the peritoneum was found even worse than anticipated, for the cyst, with thickened walls, contained over six quarts of dark discolored serum, and the cyst was uniformly fixed and bound down by adhesions to the abdominal wall and intestines. In fact, it was only by extreme caution that an adherent coil attached to the abdominal wall immediately under the line of incision escaped injury. After working with great care for over an hour to detach the densely adherent bowels, the cyst was mobilized sufficiently to exteriorize two-thirds of the sac, leaving the last segment sutured to the abdominal incision where it could drain externally through a rubber tube. In the course of the detachment of the bowel from the cyst, the intestinal walls were so thin in places that they had to be protected by a reinforcing line of sutures, as in some places it was not certain that some gas had not escaped from minute tears. The abdominal incision had to be very much enlarged to deal with the adhesions, requiring much time to close it with the through and through silver wire sutures which were in favor at that time.

In the meantime, the carbolic spray was kept going, much of the atomized vapor settling on the incision and peritoneal cavity. Of course the wide retraction of the abdominal incision with the powerful automatic retractors of the present day were missing and the systematic dressing of the edges of the incision was not yet a part of the technic. The large, soft, "elephant ear," marine sponges did good service, and they would even now be of inestimable value were it possible to sterilize them by heat once they have served in the abdominal cavity.

Fine carbolized silk was used for the intestinal sutures and ligatures but the profusion of intestinal clamps and hemostats which we now find so indispensable in present day practice were not there. It is really remarkable, as I think retrospectively, how much good work was done by the two relatively young operators who were tackling, with no previous experience in the abdomen, one of the most formidable surgical problems imaginable, at that time. I was therefore not surprised when I heard Dr. William S. say, in a low voice, "Carson, this is terrible; it is almost inviting the patient to be present at her own autopsy."

The operation had to be hurried in its last stages, as the patient was showing signs of collapse. The abdominal incision was covered with a layer of Lister's protective, parafined gauze and several layers of superimposed carbolated cotton in compact gauze bags were laid over the abdomen, which had retracted into a deep hollow, lined with relaxed skin folds. The dressing was held by strips of adhesive (diachylon) plaster and a snug abdominal binder.

Clinical sphygomanometry was still unborn, but this was not necessary to tell that the patient was suffering from shock and exhaustion. Oxygen was not then in use or available, nor intravenous infusion of saline or dextrose, and, much less blood transfusion.

Adrenalin, ephedrin and pituitrin had not yet appeared on the horizon of surgical therapy. All that could be done was to put the patient to bed, warm her with hot water cans (no electric pads then) and give camphor oil and caffein and small doses of strychnia, digitalis, atropin and morphia by needle, with a pint of hot coffee given slowly by rectum (that was long before Murphy's proctoclysis had been introduced as the classic aftermath of every abdominal operation).

Fortunately, the patient rallied for the first two days and gave promise of recovery; but, unfortunately, nephritis set in with continued vomiting (not of peritoneal origin, but uremic) and progressive oliguria and, finally, total anuria, edema of the lungs, coma and death on the sixth day. To what extent the prolonged contact of the carbolic spray had to do with the suppression of the renal function, is not certain, but the toxic effect of the carbolic spray on the

kidneys (carboluria), in prolonged operations over large peritoneal and raw surfaces had been sufficiently demonstrated to make the substitute of other less toxic antiseptics desirable. This objection with other reasons, well established by Volkmann and Thiersch, finally led to the abandonment of the spray as an obligate part of the Listerian ritual, by Lister himself, in 1887.

The history of this patient also offers a notable contrast between the powerful postoperative therapy of the present and the scant resources of fifty years ago.

Looking back to those anxious days and nights passed at the bedside of this unfortunate woman, I can imagine how much greater the chance of saving her life if we had had available donors for blood transfusion or a knowledge of the continued intravenous dextrose and salt drip, medicated systematically with adrenalin, and other cardiovascular stimulants as indicated. Besides, what an enormous advantage the duodenal tube for gastroduodenal syphonage would have been as a check to the vomiting; and again, the aid of a constant stream of oxygen by nasal intubation would have contributed so helpfully to the whole plan of relief.

A LONG DELAYED RECOGNITION OF MERIT

In connection with the early history of Listerism in the United States, I believe there can be no question that Schuppert was its first apostle in America. As previously stated, he visited Volkmann and the German clinics expressly to familiarize himself with the method so that he might apply it at once on his return to America that year. He utilized his surgical clinic at the Charity Hospital exclusively for the practice of antiseptic surgery and was promptly recognized as its ablest authority and expert. He was also the first in Louisiana, as Dr. W. Carson's guide and consultant, to direct all the details of the antiseptic technic in the first ovariotomy performed at the Charity Hospital by this method. In this he preceded Dr. Ernest Lewis (the father of gynecology in Louisiana) who extirpated very successfully a monstrous giant tumor of the ovary estimated to weigh with its fluid content, sixty-five pounds (!). This operation was performed under rigorous Listerian rules; Schuppert also preceded another operation, the third in the same year (1878) in which Dr. S. G. Choppin, an associate and great friend of Schuppert, did a successful ovariotomy for a solid growth, of moderate size. Unfortunately, the Hospital records of all these cases were lost sometime in the early nineties when a fire in the attic of the Hospital destroyed a great collection of ward histories, including that of the patient just described, without leaving a record of the precise date it was performed, except that it (Schuppert-Carson patient) antedated all the others operated that year (1878). No report of the operations performed by Dr. Lewis and Dr. Choppin were ever published except for a brief account given by Dr. Lewis in his Reminiscences. (New Orleans Med. & Surg. J., pp. 744–766, April, 24, 1922.)

Despite the fine example set by Schuppert, the Listerian technic made slow progress in Louisiana and elsewhere in the United States. So learned and progressive a surgeon as Ashurst, of Philadelphia, in the second edition of his textbook of Surgery, which was the standard in all American schools for over a quarter of a century, said, in 1878, "the alleged superiority of the antiseptic method has not yet been demonstrated." And that opinion was expressed, let us remember, eleven years after Lister had issued his first announcement of the antiseptic doctrine. Professor Ashurst, sixteen years later, in his sixth edition (1895), —[fifteen years after my graduation in 1880]—wrote approvingly of the Listerian practice, but gave his blessing in a cautious way. In this he said, "I feel compelled to say that, while I cannot subscribe to the extravagant laudations which this plan received at the hands of his more enthusiastic advocates, I believe that, when used with judgment and diluted with common

sense, it is capable of affording valuable aid." And this was indeed high praise when compared with the violent diatribes that Lawson Tait and his followers hurled against Lister and his gospel.

It is doubtful that the Listerian dressing in full ritual, of the early period, was ever applied in New Orleans outside of Schuppert's clinic. But surgical cleanliness based upon a clear conception of its germicidal purpose, with special regard to the preoperative care of the surgeon's hands and the shaving, scrubbing and washing of the field of the operation, followed by carbolated compresses, was beginning to tell for the betterment of the surgical and obstetrical services. But even in the eighties, *noli me tangere* was written large on the head, chest and abdomen, and their contained organs were still held as in sanctuaries which no one dared to open with unhallowed hands. Surgery was still largely restricted to such interventions in the visceral cavities which were made compulsory by accidental injuries and imperative vital indications. Apart from fractures, dislocations, and the usual accidents that are common to metropolitan and industrial life, the conditions for surgical treatment did not constitute more than 15 or 20 per cent of the indications that call for surgery at the present time. Peritonitis was treated as a disease without regard to its cause. It was a notable event when Homans, of Boston, on May 4, 1886, actually opened, for the first time an intraperitoneal abscess without identifying the appendix. The mere fact that a nonencysted acute intraperitoneal abscess, presumably caused by a suppurating appendix, had been intentionally sought for and opened by an abdominal incision, was regarded as a very audacious procedure (Med. Rec., New York, May 1, 1886). Operations for hernia were limited strictly to the relief of the strangulation. No laparotomies for perforating wounds of the abdomen were performed, and opium was the only and universal remedy.

The Charity Hospital of New Orleans, a state institution which dates its existence from 1832, showed a record of only 172 operations in 5,300 admissions during the year 1881, or a little over 3.2 per cent; and of these, seventy-two were amputations, thirty-two incisions for abscess, three ligations of arteries, eighteen extractions of projectiles, and one single laparotomy! In other words, 96 per cent of the cases admitted were medical and 4 per cent were surgical.

In 1890, the year when the American Journal of Surgery was founded, there were 6,083 admissions, including 291 important operations. In other words, 95 per cent admissions were medical and 4.7 per cent surgical; evidently no very great progress had yet been accomplished in the expansion of surgery.

But now in 1940, after the lapse of a semicentury of history, we find that out of 58,889 admissions for the year ending July 1, 1939, 23,473 were surgical. In other words, the treatment of disease in this hospital, which in 1881 had been a little over 3 per cent surgical, in 1940 has become 40 per cent surgical.

The experience of the Charity Hospital in New Orleans is only one example of the effect that the Listerian revolution created in hospital practice throughout the world. But this progress as we have indicated was accomplished gradually, very slowly. The year 1890, however, marked the most rapid advance. Every year after that recorded some new territory invaded, some new operation or new technical acquisition that improved and added to the dominion and security of surgical operations, especially those of the abdominal and other visceral cavities. By the end of the nineteenth century (1890 to 1900) surgeons had less dread of opening the abdominal cavity than their predecessors in performing even a minor amputation of the extremities. Abdominal surgery, especially that of the pelvic cavity, had gone so far in dealing with ovaries, uterus and adnexa, that in 1895, Dr. Chadwick, of Boston, president of the American Gynecological Association, felt it incumbent, in his presidential ad-

dress, to protest in the name of gynecology against the great excesses that were being committed in the female generative organs.

STEAM AND THE "BOILED HAND" SPEED SURGERY TO NEW CONQUESTS

By 1895, the Listerian ritual had been divested of almost all its formulas, and dry heat and steam sterilization had largely replaced chemical sterilization, except in the preparation of the skin and operating field which could not be subjected to sterilization by heat. At the same time rubber gloves introduced by Halsted, in 1890, had created the equivalent of the "boiled hand" which not only gave infinitely greater security to the manipulations of surgery, but protected surgeons' hands from the harshness and injurious effects of the chemical antiseptics of all sorts, which had been ineffectually tried in infinite ways before the boilable rubber gloves were introduced. All that remained, seemingly, as a source of infection in surgical wounds was the possibility of atmospheric contamination, which had been long since relegated to a secondary plane as a negligible quantity when the spray was abandoned as unnecessary, even by Lister himself. In this way the antiseptic practice of Lister by chemical sterilization had undergone radical modifications, while still retaining the integrity of its fundamental principles, namely, the prevention of infection in clean, uncontaminated surgical wounds and the sterilization of wounds already contaminated or infected, in which chemical sterilization still had its application. Antisepsis had yielded to asepsis, a word which Lister himself had coined to indicate a state free from sepsis or infection.

Roentgen's discovery of the *x*-rays came in 1895–1896 to inaugurate a new agent of transcendent importance for the development of surgery. By illuminating the body, diagnosis was marvelously simplified and immediately the indications for surgery prodigiously multiplied.

Roentgenology supplemented by the constantly growing collaboration of the physiological and biochemical laboratories, all combined to so rejuvenate and transform the face of surgery that it was no longer recognizable in the light of its ancient portraiture.

THE EVOLUTION OF MODERN SURGERY*

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"WHERE the love of man is, there also is love of this Art."

By way of introduction we might inquire what we mean by modern surgery and who was the first modern surgeon. Certainly, surgery reached a high degree of technical precision, dexterity and speed before anesthesia was discovered or Lister came upon the scene. The treatises on dislocations, on fractures or on wounds of the head of the Hippocratic collection are essentially modern.[1]

Medicine is the reflection of the religion, the culture, the politics and always the economic condition of the time. One could write the story of philosophy, of physics, of chemistry or the political economy of a period from the biographies of the personalities of medicine. It is historically an arresting fact[2] that the three periods of the greatest activity of mankind have been those associated with a phenomenal increase in intellectual and scientific development as well as the expansion in politics, geographical discovery and economic wealth. The crowing age of Greece with its liberal mind and pure reason was founded upon a despotism of slavery. The Renaissance with its revolt against authority and tradition was built upon the wealth of the Indies after Columbus, Cortes and Pizarro. The nineteenth century with its science and machine power was to introduce the industrial revolution and to develop the huge population concentration of the city and mass production. The industrial age was to affect medicine in many diverse ways.

Two lines of development became evident. The first development was to be distinguished for inventions and discoveries in physics and chemistry, with the founding of bacteriology, physiology and pathology as new disciplines, with the rise of experimental medicine and comparative anatomy and more recently the complete dominance of therapy by synthetic chemistry—medicine chemurgic.[3,4] The second development was to concern itself with medical organization for social services:[5] the rise of medical societies, health departments, school medical service, industrial medicine, workmen's compensation insurance and finally a hybrid protege—medical economics. One may pause and wonder whether medical economics and state medicine may not be suppressing the individual and creative minds of our profession. The medical mind is sufficiently egalitarian to want the benefits of modern medicine extended to all our population but at the same time is very reluctant to destroy the individual creative spirit of the physician by a compulsive conformity to political authority or bureaucratic standards of medical service.

To say that surgical progress is the result of a collective mind working through the centuries is to oversimplify the subject. Yet the analytic historian is tempted to divide time into separate epochs and to ascribe common characteristics to each era. In Greece and Alexandria, for example, medicine and surgery were one, springing from the obscurity of pagan and temple medicine and becoming rational medicine under Hellenic influences. The evolution of modern surgery was the result of a profound change in mental and social outlook. Surgery began to be modern when certain types of mind began to break with authority and to think in terms of individual creative effort.[6]

* The John Chalmers Da Costa Oration, Philadelphia County Medical Society, Philadelphia, Pennsylvania, April 10, 1940.

Greek medicine was founded upon the ability to observe and to record medical facts—"the collation of experience from various sources and obtained by various methods."[1] Hippocrates (460–370 B.C.) showed that diagnosis could be accurate, treatment logical and prognosis definite. The heritage of Greek medicine was to be destroyed by conquest and only fragments were to be preserved in commentaries by Arabian translators of the Nestorian translations of the Greek medical books. The thousand years of medievalism were to mould the mind into a compulsive uniformity with its lack of intellectual curiosity, and clinical observation was destroyed by reverence for tradition and authority. A single universal power—church or empire—was to sanction all thought and destroy all initiative. One of the unhappy results was a complete divorcement of medicine and surgery, a separation that has unhappily continued to this day.[7]

Science depends on intellectual curiosity and individual research and with the courage to break with authority and tradition. From the shadows and twilight of the medieval period was to emerge the "tremendous universal genius," Leonardo da Vinci (1452–1518), "the incarnation of the true spirit of the Renaissance."[2] From his practical and utilitarian mind was to come a rebirth of intellectual interest, a rediscovery of the experimental method of Hippocratic medicine. Da Vinci was the first modern architect of scientific progress. His varied research in all fields of knowledge, his dissection of the human body with his incomparable drawings were to anticipate a new science of human anatomy, a necessary prelude to modern surgery.

Eight years (1526) after the death of Leonardo, when there was that strange combination of revolt, learning and charlatanism, Paracelsus would dramatize in Basle the revolt from medieval authority by burning the sacred volumes of Galen, Avicenna and Averroes. "Follow me," he cried, "not I, you!" New disciplines in science were being initiated; an era of fact-finding and research was at hand. The mind of the Renaissance had replaced the medieval.

A pleasant exercise of the intelligence is to discuss an epoch as a fixed point of time. One of the most impressive passages in the "Decline and Fall of the Roman Empire" is employed by Gibbon with striking effect:

"If a man were called to fix the period in the history of the world, during which the condition of the human race was most happy and prosperous, he would without hesitation, name that which elapsed from the death of Domitian to the accession of Commodus."[10]

Using the distinguished historian as an example we may predicate that if one were called to fix the period that marked the separation from ancient medical practice to modern he would select 1543. In that year were published two books, both by physicians, that changed the entire scientific thought of the world. The first by Nicholas Copernicus (1473–1543), "On the Revolutions of the Celestial Spheres," and the second by Andreas Vesalius (1514–1564), "The Fabric of the Human Body." The former was to change completely our knowledge of the heavens and to remove the earth from the center of the universe.[1] The latter was to revolutionize traditional medicine and destroy the authority of Galen. It was to be the real foundation of modern anatomy and the first great scientific contribution of modern times.

Ambroise Paré (1510–1590), the first modern surgeon, was thirty-three years of age when the masterpiece of Vesalius was published. Alone he stands as an original inventive genius. He believed, however, that the plague came by Divine will, that spontaneous generation was a fact for he had seen maggots grow in war wounds; he also had faith in the royal touch for the King's evil. But Paré had a modern mind and many of his ideas have been incorporated into modern surgical practice.[8] Two discoveries are certainly to his credit: the first, that gunshot wounds were not poisonous and that they should not be treated

with scalding hot oil, or amputations treated with red hot, soldering irons; the second discovery, somewhat less secure, was the use of the ligature in amputations for the control of hemorrhage. The ligature for the control of bleeding in wounds was as old as history. It was used for stanching blood in Greek and Roman surgery. Galen bought his ligatures "celtic linen thread in the Via Sacra between the Temple of Rome and the Forum."[7] Paré recommended good threads, two together—"bon fil qui soit en double"—and also devised a catch forceps very similar to our modern hemostats. He was a God-fearing man, with strong lapses into superstitious practices but withal an independent thinker. "You will have to render an account not to the ancients," says Paré, "but to God for your humanity and skill." In his "Journeys in Diverse Places" he describes how Captain le Rat at the Pass of Suze en route to Turin received an arquebus shot in his right ankle and fell to the ground exclaiming, "Now they have got the rat." Paré laconically remarked "I dressed him and God healed him."[8]

From the Greeks medicine derived two great contributions: a man and a method. In a similar sense modern surgery inherited from Paré the picture of a splendid humanitarism and a surgical method. His personal influence must have been tremendous both with royalty and the soldiers. It is recorded that in October, 1552, when Charles v laid siege to Metz which was defended by the Duke of Guise, Paré entered Metz December 8, 1552. Guise presented him on the ramparts to all the soldiers. "We shall not die," they exclaimed, "even though wounded, Paré is among us."[11] His attainments as a clinician are attested by a modern critic of great ability. "Put Ambroise on one side of a patient's bed and a surgeon of our own day, single handed on the other and you will not find the balance of insight on practicality against Ambroise."[8]

Paré at sixty-five could see very little future for surgery. "God is my witness, and men are not ignorant of it, that I have labored more than forty years to throw light on the art of surgery and bring it to perfection. And in this labor I have striven so hard to attain my end, that the ancients have nough wherein to excel us, save the discovery of first principles: and posterity will not be able to surpass us (be it said without malice or offence) save by some additions, such as are easily made to things already discovered."

Preceding the entrance of Paré upon the surgical stage there was a thousand years of the barber and barber-surgeons. In Greece and Alexandria medicine and surgery were one, and even in the time of Galen (130–200) there was no divorcement of surgery and medicine.[7] The medieval mind, however, wanted some central authority, a spiritual power that was socially integrative. This centralized power would be either the church or the empire. The Koran prohibited human dissection as the Arabs believed it was unclean and unholy for human hands to mutilate the dead body. The few books that have been preserved were commentaries on porcine dissections. Even these books were fragmentary as many of the originals were lost. Thus Galenical anatomy was the sole anatomic authority until Vesalius. Henry of Mondeville expressed some doubts for he declared that God did not exhaust His creative powers in making Galen.

The practice of the barbers was accelerated when the monks were forbidden in 1092 to have beards and shaved faces became the fashion. Thus arose a group of menials or tonsors and scullery helpers, and later bath keepers who performed all sorts of odd jobs. Finally their activities were enlarged for the Council of Tours in 1163 prohibited the monks from practising incision and bleeding. The church abhorred the shedding of blood—"Ecclesia Abhorret a Sanguine." Thus surgery in the thirteenth and fourteenth centuries, with anatomy proscribed by the religion of the Arabs and blood-letting prohibited by the church, had no honor, no friends and no recognition.

A Modern Operation

The practice of surgery became a manual trade in the hands of the barbers and menials. These questionable gentlemen were bold, brazen, clever, with deft fingers, utterly unscrupulous, restricted by no code of ethics, without social responsibility and believed that blood-letting was a cure-all for every ill. They were ready to bleed patients at any and all times, for any and all conditions but always for money.[12]

There were, however, among their number some who aspired to greater things and at about the time that Paré, the son of a barber-surgeon, came upon the scene there were in Paris three definite groups dealing with medicine—the physicians, the surgeons and the barbers. The barbers and barber-surgeons were organized into a corporation of the barber-surgeons, while the surgeons were similarly organized into the confraternity of St. Come. The latter were barber-surgeons that had been admitted into the confraternity after examination and wore a square hat and a long robe and were designated the barbers or surgeons of the long robe. Medicine, however, was taught by the physicians in the Faculty of Medicine of the University of Paris and for many years there was a triangular fight among these three organizations.

Paré, barber-surgeon, legally could not be admitted to the confraternity because he could neither speak nor read Latin. He says, "I desire not to arrogate to myself that I have read Galen either in Greek or in Latin: for it did not please God to be so gracious to my youth that it should be instructed either in one tongue or in the other." However, he was surgeon to the king and a man of such prominence that after considerable sculduggery he was admitted, enrolled, registered and crowned a barber-surgeon in 1554. The confraternity at that time called itself euphemistically, "The Royal College of Surgeons of Paris."

The same story could be repeated in Great Britain. The barbers became the guild of barber-surgeons in 1462, a city company with a royal charter. The surgeons disassociated themselves from the barbers by an Act of Parliament in 1745 and became the masters and governors of the art and science of surgery. Later in 1800 they were incorporated by a charter as the Royal College of Surgeons of London and in 1843 became the Royal College of Surgeons of England.[13] Thus surgery had its origin like Cinderella in the scullery and from the ashes and debris was elevated to the companionship of kings, for Astley Cooper (1768–1841) was made a baronet sometime after he had removed a wen from the royal head of King George the IV.[14]

The transition of surgery of the sixteenth century to its specialistic elaboration of the eighteenth was roughly 138 years, or the span of years from Paré to John Hunter (1728–1793). There are many points of similarity in the lives and surgical activity of these two men. In the mental equipment of both was a profound intellectual curiosity and ability to observe, to compare, and to record, combined with a positive genius for experimentation. Hunter's famous injunction to Jenner (1749–1823), "Don't think, try: be patient, be accurate,"[15] is duplicated by the experience that Paré narrates on the question as to whether a mass of protruding cerebral tissue was fat and not brain. His interrogator insisted that the protruding mass was fat. "None the less," said Paré, "he kept trying to gainsay me by constant argument. At last I told him experiment should decide between us. If it were fat, it would float on water, and would melt if you put it on a hot shovel."

John Hunter and his brother, William Hunter (1718–1783), probably represent the greatest team in the history of surgery. William Hunter was the first great teacher of anatomy. At the time of the Hunters individual surgeons organized classes in anatomy and surgery and a young man desiring to study surgery apprenticed himself and in many instances lived in the domicile of his preceptor. The teaching of William Hunter differed from that of his contemporaries in his original research

work, in the application of anatomy to surgical procedures and in the fullness and thoroughness of his instruction. His far greater brother, John Hunter, was to advance both the knowledge and practice of surgery to a new level of science. Hunter was the first great comparative anatomist and physiologist. He was the founder of experimental and surgical pathology. He believed that the principle called "life" existed beyond mere structural and functional morphology. His practical mind applied the lessons of comparative anatomy to the elaboration of the physiology of the human. He was the first great pathologist and never lost sight of the practical utility of pathology as a means of surgical knowledge, treatment and prognosis.

He was the first to claim that knowledge of anatomy alone is not a sufficient foundation for the study of surgery. He was to add to the physiologic researches of Harvey and to establish the first great collection of pathologic material now represented by the Hunterian Museum in London. From the encyclopedic range of his mind he might be called the Leonardo da Vinci of surgery. His varied researches included studies of geology, hibernation of animals, coagulation of blood and body fluids and descent of the testis in the fetus. He was the first to discover that the blood of primates and red blooded animals is in the beginning colorless thus resembling the blood of the invertebrates.

John Hunter "found surgery a mechanical art and left it an experimental science."[15] He extended the horizons of medical knowledge, elevated the social status of the surgeon and gave them a position of assured scholarship and educational background. He richly deserved the title of Father of Modern Surgery and justified the words of one of his colleagues, "He alone made us gentlemen."

His research genius is well illustrated by an example. Along about 1785 he tied one of the external carotid arteries of a buck and observed that the antler on that side became cold and growth was retarded. Some weeks later he found that the antler had regained its heat and was again growing. On doing a post-mortem examination he discovered that the external carotid artery had been well tied and was completely occluded but under the "stimulus of necessity" a collateral circulation had been established around and over the occluded artery. It was from a planned experiment such as this that Hunter devised his operation for popliteal aneurysm, a surgical procedure that has saved numerous lives, no less than limbs, while Hunter's canal has become the anatomic landmark for his operation. Nothing in the realm of human knowledge seems to have escaped his scientific curiosity and whatever problem engaged his interest he left it enriched by his genius. The master word of his life was work.

Surgery is based upon three fundamental conceptions:[16] (1) the control of hemorrhage; (2) anesthesia, (3) the prevention of infection—sepsis. The control of hemorrhage by various technical procedures is as old as man. Certainly, in the most rudimentary society hemorrhage was probably the first and foremost cause of death. The practical mind of primitive man must have devised means of stanching the flow of blood. In the earliest archeologic records are found illustrations and descriptions of various types of tourniquets and the methods of their application. The ligature as a means of stopping hemorrhage in wounds goes beyond the antiquity of Greece.

Anesthesia, a word coined by Oliver Wendell Holmes, cannot now receive the treatment that it deserves. The first allusion to anesthesia occurs in the first chapter of Genesis, when God created Eve, He "caused a deep sleep to fall upon Adam." Literature is rich with its references to various medicaments that might assuage pain—Indian hemp, poppy, henbane and mandragora. Ulysses and his daring companions were narcotized by nepenthe, and Christ is alleged to have received a draught of vinegar and myrrh. The Chinese used

bang and hasheesh, Cannabis indica.[11] Crude opium and derivatives had extensive use through the middle ages. Marco Polo probably had some opium in his baggage when he returned from China. The caravans carried on an active trade in drugs and transported opium from the far East to the Mediterranean.

The discovery of anesthesia has been told many times. The painting by Robert W. Hinckley of the first planned demonstration of general anesthesia with ether by Morton on October 16, 1846, at the Massachusetts General Hospital is familiar to all. The fate of the men identified with ether anesthesia, with the exception of Long, was tragic in the extreme. He alone seemed to have carried on his ordinary life as a physician and his tragedy was in his delay in having an official publication of his discovery. Wells, in a fit of despondency committed suicide. Morton tried to patent ether under the name of "letheon," but died of apoplexy in abject poverty, while Jackson spent his last days hopelessly mad.

Anesthesia changed the character of surgery. From being a technical procedure of great skill, speed and dexterity, reserved solely for emergency operations and formerly associated only with grave wounds of violence, such as the battlefield—"for the blood of soldiers made many surgeons" —surgery, after anesthesia became an elective operation where speed, dexterity and manual strength were relegated to the background, while precision of mind and surgical judgment became the dominant factors. Surgery was a very precise, technical procedure before anesthesia and Lister, as witnessed by the outstanding names of the seventeenth and eighteenth centuries in England, Wiseman (1622–1676), Cheselden, Astley Cooper (1768–1841), and later Liston (1794–1848) who could amputate a thigh in the miraculous period of three minutes or less by using his left hand as a tourniquet.

Anesthesia enlarged the domain of surgery. It made possible the "planned operation" with its careful preoperative preparation. In a more subtle way, it advanced surgery because of the change it wrought in pathology. Before anesthesia pathologic material was largely composed of amputated legs, a few tumors and postmortem examinations. In essence the pathologic examination was a mortuary affair. With anesthesia came "the pathology of the living," the visualization of tissue changes during the life of the individual. Thus a new concept of pathology was to be written as the result of anesthesia and the planned operation. Much, however, remained to be accomplished. Surgery was to be made safe for the patient.

Pasteur (1822–1895) was born twenty-nine years after the death of John Hunter. Although a chemist he is one of the tutelary gods of medicine and occupies an exalted place in the Pantheon of Science. His researches destroyed the theory of spontaneous generation, established the germ theory of disease and initiated the science of bacteriology. It is a notable fact that medicine has benefited repeatedly by discoveries in the realm of pure science. It may be stated that the precise chemical and physical research of Pasteur with isomeric tartrates was the initiatory step that made Listerism possible. Isomerism had been noted before Pasteur. It was also known that there was deposited from wine lees two kinds of tartaric acid: one of these was dextrorotary to polarized light, while the other possessed no rotary power. Pasteur demonstrated that the inactivity of the one acid was due to its being composed of two isomeric constituents, one of which was dextrorotatory and the other levorotatory. When the two isomeric constituents were fused there was no rotation. Following this discovery Pasteur prepared the inactive form of tartaric acid and later observed that when this was fermented by a special mould—pencillium glaucum—the right-handed dextrorotatory acid alone was destroyed. In turn he studied the "souring" of beer and wine sickness and proved that the various changes which occurred in the process of fermentation were due to the

presence of invisible organisms and that these germs were not spontaneously generated. Every living thing comes from a similar and preceding form—omne vivum ex vivo. Later, he devised the mechanism for developing immunity against cholera, anthrax in animals and hydrophobia in humans. In the field of preventive medicine he shares with Jenner the extraordinary distinction of having devised an effective means of preventing a disease without its causation being known. My mind likes to dwell upon great personalities who throughout time have become crystallized into symbols of scientific progress. Pasteur began his career with the master word for great accomplishment—work. The last words he ever uttered were "Il faut travailler." It is necessary to work! In 1854 Pasteur was appointed professor of chemistry and Dean of the Faculté des Sciences at Lille. In his inaugural address he stated, "In the field of observation chance only favors those who are prepared."[17] Joseph Lister (1827–1912) was born one year earlier than Pasteur and "was prepared," for the philosophy of Pasteur was to introduce Listerism and aseptic surgery. Modern surgery was to be consummated.

It is an ironical fact that while anesthesia enlarged the field of surgery, both technically and diagnostically, it increased the deaths from sepsis. Hospitals were held in great dread as a place where death was inevitable. Five major infectious conditions dominated the mortality lists—hospital gangrene (sometimes spreading through the entire ward or hospital), pyemia, septicemia, wound suppuration and erysipelas. By anesthesia "surgery had enlarged its freedom only to find the weight of its new responsibilities more than it could bear."[18]

Few of us can realize what antiseptic surgery really initiated. Many of Lister's contemporaries were under the impression that it was a new form of chemical treatment of wounds. Its basic philosophy was somehow lost sight of in the controversy that followed. Taking Lister's own work, we can form some idea of what was accomplished by comparing his statistics on amputation before and after the application of his method.[1]

Years	Cases, No.	Recoveries, No.	Deaths, No.	Mortality, Per Cent
1864–1866	35	19	16	43 without antiseptics
1867–1870	40	34	6	15 with antiseptics

The immediate changes induced by antiseptic surgery can also be roughly measured by the death rate for amputations. In the Pennsylvania Hospital for thirty years before 1860 the mortality rate after amputations averaged 24.3 per cent, in the Massachusetts General Hospital, 26 per cent and at Zurich the rate was 46 per cent.

Sir John Erichsen, professor of clinical surgery at the University College Hospital, London, wrote, "A general mortality of many years from 24 to 26 per cent in all major amputations may be considered a very excellent result. It is one of which we need not be ashamed." To learn in more definite terms, however, what was to happen after Listerism is to understand the magnitude of the extension of the field of surgery. Taking for example, St. Bartholomew's Hospital in 1848, it had 397 beds for surgical patients yet not more than 400 operations were performed each year and approximately 100 of these were amputations. In the year in which Lister died, 1912, St. Bartholomew's had relatively the same number of surgical beds, but 3,561 operations were undertaken and exactly 25 of them were amputations, or 0.7 per cent.[14]

Amputation was the most frequent surgical operation by the middle of the nineteenth century. A simple fracture recovered without infection. A compound

fracture always became infected. The patient would either die of general sepsis, without amputation, or suffer an amputation, with a 25 to 50 per cent chance of dying, or make a recovery after an interminable period of wound infection. There is only one circumstance in these two examples that is fundamentally different, namely, the compound fracture had a laceration of the skin and an atrium for the admission for microorganisms.

Robert Brown (1773–1858), an English botanist, had published in 1827 an article dealing with certain rapid movements and oscillations of particles both when observed in a beam of light in a dark room and also under the microscope. Later, John Tyndall (1820–1893) had described floating matter in the air. Pasteur had shown in one of his experiments that the air at the top of a high mountain was practically sterile and free from life or floating particles, while the atmosphere on the surface of the earth, or in rooms, halls or on the streets was literally alive with micro-organisms. Pasteur had destroyed the theory of spontaneous generation and from his studies Lister was able to establish two fundamental concepts: (1) that putrefaction was due to germs and that these germs were either in the air, in the wound, upon the persons or on the materials that touched the patient; (2) these germs did not originate "de novo" but came from other germs exactly like themselves.

The surgical philosophy of antiseptic surgery was gradually developed by Lister from a well considered and reasoned hypothesis. In 1853, in a paper, "The Early Stages of Inflammation," Lister determined that inflammation was essentially the reaction of body tissues to irritation, accompanied by an increased vascularity and dilatation of the blood vessels with a flux of both red and white corpuscles into the area. Unknown to him apparently was the work of Wallin six years earlier in 1847 who had demonstrated that inflammation was essentially diapedesis of the white blood corpuscles from the blood vessels into the wound. Further weight was given to this early premise by Cohnheim in 1878 who came to the conclusion that the migration of white blood cells into the area of inflammation was the basic feature of inflammation and pus was simply a collection of dead and disintegrating white leucocytes. In the Lancet, of March 16, 1868, seventy-two years ago, Lister published the first of his epoch-making contributions entitled, "On a New Method of Treating Compound Fracture, Abscess, etc., with Observations on the Condition of Suppuration." He developed his conception as follows:[19]

"Turning now to the question how the atmosphere produces decomposition of organic substances, we find that a flood of light has been thrown upon this most important subject by the philosophic researches of M. Pasteur, who has demonstrated . . . that the air owes this property, but to minute particles suspended in it, which are the germs of various low forms of life . . . Applying these principles to the treatment of compound fracture . . . it appears that all that is requisite is to dress the wound with some material capable of killing these septic germs. . . . In the course of the year 1864 I was much struck with an account of the remarkable effects produced by carbolic acid upon the sewage of the town of Carlisle, the admixture of a very small proportion not only preventing all odour from the lands irrigated with the refuse material, but, as it is stated, destroying the entozoa which usually infest cattle fed upon such pastures.

"My attention having for several years been directed to the subject of suppuration, more especially in its relation to decomposition, I saw that such a powerful antiseptic was peculiarly adapted . . . for the treatment of compound fractures.

"My first attempt of this kind was made in Glasgow Royal Infirmary in March 1865, in a case of compound fracture of the leg. It proved unsuccessful, in consequence, as I now believe, of improper

management: but subsequent trials have more than realised my most sanguine anticipations."

At first Lister believed that the air was the main feature of infections. It was many years before air contamination was to be proved the least important factor in the development of sepsis. The fact that a pathogenic micro-organism must come from other pre-existing forms of the same type explained contact infection and the contagiousness of infection in hospital wards. It was not long, however, before the air acquired a secondary place and antiseptic surgery was to give way to the perfected Listerism—aseptic surgery, about 1890.

Von Bergman was to devise the steam sterilizer in 1886, and in 1890 W. S. Halsted, then of New York, was to have bronze casts made of his hands, and introduced rubber gloves into surgery—"the hand of iron in the glove of rubber." Even as late as 1913 in the Post-Graduate Hospital in New York City, it was necessary to make it mandatory for surgeons to wear rubber gloves during any surgical operation.

Sir John Erichsen, professor of clinical surgery, at the University College Hospital, London, where Lister served as a house surgeon, in the course of an address in 1873, five years after Lister's paper, stated: "The art of surgery is but the application of manipulative methods to the relief and cure of injury and disease. Like every other art, be it manipulative, plastic or imitative, it can only be carried to a certain definite point of excellence. An art may be modified, it may be varied, but it cannot be perfected beyond certain attainable limits. And so it is, and indeed must be, with surgery. There cannot always be fresh fields for conquest by the knife: there must be portions of the human frame that will ever remain sacred from its intrusion, at least in the surgeon's hands. That we have nearly, if not quite, reached these final limits, there can be little question." A year later Erichsen was to add that, "The abdomen, the chest, and the brain would be forever shut from the intrusion of the wise and humane surgeon."[14]

Lister made his first announcement of antisepsis in 1867 and visited the International Medical Congress in Philadelphia in 1876. Five years later, on July 2, 1881, President Garfield was shot through the chest and died two months later on September 19, 1881, of sepsis, fourteen years after the discovery of antisepsis. It is interesting to note that at the time of Lister's visit to Philadelphia, Samuel D. Gross (1856–1882) was professor of institutes and practice of surgery at Jefferson Medical College. In the "Autobiography of Samuel D. Gross, M.D.," edited by his sons, there are two references, and *only* two, to Lister. "Our first stopping place (1868) was the old Royal Infirmary (Glasgow) in the building in which Professor Lister, first put in practice what is now known as his dressing." Again, 1880, twelve years later, "Directly opposite to me was Mr. Lister the famous reformer of the surgical treatment of wounds and other injuries."[20]

If the Emperor of American Surgery[21] missed the philosophy of Listerism in 1880 is it any wonder that for many years it was considered a new fangled dressing for wounds. The American adoption of Listerism and its perfected by-product, aseptic surgery, was to await the arrival of William Keen as professor of surgery at Jefferson in 1889. The way of the reformer was more difficult than the way of the transgressor.

It is sometimes interesting to observe how frequently an idea germinates in the minds of different individuals at the same time. This coincidence has frequently been demonstrated in literature in which authors thousands of miles apart and unknown to each other have written approximately the same story. Darwin's origin of the species was almost duplicated by Wallace in India and the descriptions of the radical amputation of the breast by Halsted in Baltimore and Willy Meyer

in New York were published within two or three weeks of each other, and the work of each was totally unknown to the respective authors.

By way of digression we may take up the story of two physicians: one an American doctor, an anatomist and a great master of literature; and the other a young Hungarian physician in far away Vienna. In April, 1843, Oliver Wendell Holmes published an article in the New England Quarterly Journal of Medicine and Surgery on "The Contagiousness of Puerperal Fever."[22] "The disease known as Puerperal Fever is so far contagious as to be frequently carried from patient to patient by physicians and nurses." The hypothesis of Holmes' occasioned one of the most celebrated controversies in American surgical literature. Dr. Hugh L. Hodge, professor of obstetrics in the University of Pennsylvania, in 1852 responded: "The discussion will . . . divest your minds of the overpowering dread that you can ever become, especially to woman, under the extremely interesting circumstances of gestation and parturition, the minister of evil; that you can ever convey, in any possible manner, a horrible virus, so destructive in its effects, and so mysterious in its operations as that attributed to puerperal fever." Dr. Charles D. Meigs, professor of midwifery and diseases of women and children in Jefferson Medical College in 1852 contributed his thoughts: "I prefer to attribute them to accident, or Providence, of which I can form a conception, rather than to a contagion of which I cannot form any clear idea, at least as to this particular malady." And, two years later, in 1854, he added rather pedantly, "In the propagation of which (puerperal fever) the physicians have no more to do, than with the propagation of cholera from Jessore to San Francisco, and from Mauritius to St. Petersburg." Thus began a surgical epic.

In Vienna, in 1844, Ignatz Phillip Semmelweis, had just graduated from the Medical Department of the University of Vienna. In the Lying-in Hospital of Vienna there were two departments. In the first the women in labor were attended by medical students, with a maternal mortality never less than 10 per cent and usually over 30 per cent. In the second hospital, the women in labor were attended by midwives with a maternal mortality of about 3 per cent. The horror of the maternal mortality in the first hospital on the extraordinarily sensitive mind of Semmelweis was emphasized by the visits several times a day of the priest, proceeded by a choir boy tinkling a bell to give the last sacrament to the dying. "The bell became an exhortation to search for the cause." Semmelweis attended the post-mortem examinations on the women dead from puerperal sepsis and four years later he was to be present at the autopsy on one of his friends who had died of blood poisoning, the result of injuring his finger when performing a post-mortem examination upon the body of a woman who had died of child-bed fever. Semmelweis was impressed when he saw that the tissues of his dead friend were exactly similar to those observed in the women dying of puerperal fever.

The answer to the causation and transmission of puerperal fever was at hand. The medical students left the dissecting room and delivered the women in labor in the first hospital. Therefore, the "contagium vivum" was carried by the students. A great surgical epic began with the simple injunction "you must wash your hands."[12] Semmelweis wrote: "In order to crush the cadaver fragments adhering to the hands, about the middle of May 1847, I used chlorine liquids, with which I and all my students had to wash their hands." The maternal mortality in the first hospital became comparable with that of the midwives in the second hospital. The conquest of puerperal sepsis by simple surgical cleanliness was initiated. Pasteur, Lister and Koch were still in the future but Holmes in America and Semmelweis in Vienna were both present at the dawn of a new era in surgery.

In justice to the subject a few words should be added regarding personal cleanliness and absence of body filth in the evolution of Surgery. The ancient Greeks practised personal cleanliness and their surgery was clean surgery. The Romans with their genius for organization as exhibited by their aqueducts and baths practised clean surgery, and clean surgery is successful surgery. With medievalism the value of temporal life was held in slight esteem. Everything was spiritual and happiness was looked for in a glorious hereafter. The wars with the movements of troops, the crusades and the pilgrimages made beggary a spiritual calling. The flesh was scourged, mendicancy and dirt were everywhere and clean surgery was impossible. One Roger Frugardi, of Palermo (circa 1170), introduced the seton as a means of creating "laudable pus" in wounds. He believed that the healing of wounds by first intention was beyond surgical skill. About 1266, Theodoric, a chaplain of the Preaching Friars, disclaimed against the theory of laudable pus and said: "For it is not necessary as Roger has written, as many of their disciples teach, and as all modern surgeons profess, that pus should be generated in wounds. No error can be greater than this. Such a practice is indeed to hinder nature, to prolong the disease and to prevent the conglutination and consolidation of the wound." Theodoric was as great an original thinker as Lord Lister but he lived six hundred years too soon, for back in 1266 Theodoric was pointing the way to clean surgery. It is rather interesting that Lawson Tait (1845–1899), the leading gynecologist of England of the nineteenth century, was the most empassioned opponent of Lister. Tait never understood antisepsis but insisted on strict surgical cleanliness. He could not see any relationship between sepsis and bacteria, or disease and soap and water. He flushed his operative wounds, even the abdominal cavity, with boiled water. He practised aseptic surgery before the word was coined.[14]

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A HALF CENTURY OF ABDOMINAL SURGERY

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MOST available histories of surgery, such as that by D'Arcy Power, carry the story of the development of surgery to the Listerian and postanesthetic period. Daring surgeons had penetrated the abdomen, and various surgical procedures had been performed involving almost every one of its contents. Few surgeons, however, had deliberately planned abdominal operations, and fewer had had any conspicuous success. With anesthesia and antisepsis the foundations of modern surgery were laid. Thus the edifice of modern surgical science is erected on the pillars of anatomy and bacteriology and supported by anesthesia and asepsis. As Power stated, "Anatomy, indeed, still forms the basis of operative surgery, but physiology is beginning to occupy an important position in the prevention of those conditions which, if left unrecognized, often require surgical interference. . . . There is still much to be explained, much to be differentiated, and much to be done. The older surgeons operated, thinking only to save life; the younger surgeons operate to discover the cause and to prevent its continuance. They operate to cure."

The importance of Lister's discoveries in the rapid development of abdominal surgery cannot be overemphasized. Anesthesia was discovered almost fifty years prior to the period which we portray. The peritoneum formed a barrier which the boldest surgeon hesitated to traverse. And when one of them did traverse it in a bold pioneering adventure, his accomplishment was hailed by some, but promptly forgotten by most. McDowell's great feat could not stand successful repetition, and it was not attempted in large metropolitan hospitals. The fear of suppuration and peritonitis was too real. The technic of antisepsis, before it gave way to asepsis, was slow to develop. Lister did not abandon the carbolic spray until 1887, six years after Billroth (who at first opposed antiseptic surgery) had successfully removed a portion of the stomach.

The acute intra-abdominal surgical emergency was a vexing problem during most of the nineteenth century. Appendicitis had not been resolved into a definite entity. It had existed in past centuries as a fatal blight, which lack of postmortem study and diffuse peritonitis completely obscured. Addison and Bright wrote a clear and in many ways modern description of the disease in an unpublished manuscript of 1838. Perforation of the appendix associated with peritonitis, however, while recognized by some did not gain scientific prominence until 1886. Fitz' paper of that year was so complete and thorough that modern discussion and investigation has had as yet little to offer in the way of improvement. The recognition of this disease, the treatment of which probably necessitates the most frequent invasion of the peritoneal cavity by the surgeon, is among the most important contributions of American medicine. The scientific analysis of this disease on a clinical and pathologic basis by Reginald Fitz gave world-wide impetus to the removal of the diseased appendix. In England Sir Frederick Treves, the King's surgeon, boldly urged early appendectomy, a plea that fell on a considerable number of deaf ears among the conservative London physicians. Kronlein, in 1884, had already performed an appendectomy in a case of diffuse appendiceal peritonitis. His patient did not recover. It remained for an American, R. J. Hall, first to remove an inflamed appendix. Thomas G. Morton, of Philadelphia, in 1887, was the first delib-

erately to plan and perform the operation of appendectomy. Shortly thereafter came the work of McBurney, Sands, A. J. Ochsner, J. B. Murphy, J. B. Deaver and Fowler. George Ryerson Fowler published a series of papers in 1894 on appendicitis (later published in book form). Fowler was a Brooklyn physician and Wm. Cruikshank, writing in 1912, referred to Fowler as one "without whose name the history of appendicitis could not be written." To complete the story Fowler himself died in 1906 from acute appendicitis (Royster).

Thus, by the turn of the century appendectomy was a well established procedure, only the addition of the Fowler position being considered an additional worthy contribution. This dramatic evolution of the surgery of appendicitis from obscurity to prominence took place in two decades. It began before Lister had completed his antiseptic technic. Yet it owed its existence to the stimulus which his researches had given. The hopeless purulent tragedy which was appendicitis gave way to a new concept of perforative appendicitis. The ubiquity of appendicitis, and the relative impunity with which the surgeon could invade the peritoneal cavity, made hundreds of abdominal surgeons where none had existed previously.

This period at the turn of the century may well be called the formative period of abdominal surgery. During these few years more "firsts" in abdominal surgery occurred than in all the previous ages of mankind. Surgery of the gastrointestinal tract advanced more rapidly than that of any other single system of the body.

Maes has emphasized, in a review of the "Transactions of the American Surgical Association," the sudden interest displayed in gastric surgery after 1900. From 1884 to 1889 not one paper was presented on this subject at the annual meetings. The president of the society mentioned Billroth's operation as "sub judice and on trial." But by 1900, 231 of the 420 pages of the "Transactions" dealt with gastric surgery.

This sudden development of, and the world-wide interest in, gastric surgery are indicative that surgeons everywhere were searching for new successful means to treat ever present gastric diseases. The history of gastric surgery includes many of the most famous surgical names, although the entire life span of successful gastric surgery lies almost entirely within our modern period.

The earliest operations on the stomach were those of necessity and were possibly performed in antiquity. Schwaben, in 1635, removed a swallowed knife from a farmer's stomach. Paré wrote a treatise on gastric wounds, speaking with the authority of an experienced army surgeon. The most famous American physiologic subject, Alexis St. Martin ("this old fistulous Alex") might readily have been cured with modern surgical methods. Kocher reported a successful repair of a gunshot wound of the stomach in 1884, and Heusner of Barmen (1891) successfully repaired a perforated peptic ulcer.

Gastrostomy early occupied the attention of numerous surgeons. Sedillot, in 1845, attempted unsuccessfully to perform such an operation. Fenger made an unsuccessful attempt in 1853. Sydney Jones reported a successful attempt in 1875; Verneuil published his case report in 1876 and reviewed all twenty previous attempts which were failures. In 1900 Gross, reporting to the American Surgical Society, stated that gastrostomy was a useful operation. By then a multiplicity of technics had developed so that Marwedel described three distinct types of gastrostomies in 1896: (1) Sphincter in abdominal wall (von Hacker); (2) sphincter in stomach wall (Uhlman); and (3) artificial diverticulum or fistula (Hahn, Witzel, Frank and others). In this country Senn wrote papers on the subject in the same year. He noted that gastrostomy carried a much higher mortality than colostomy.

Meanwhile from European clinics came records of gastric operations of another sort. In 1877 Billroth, after repairing a gastric fistula, said "from this operation to

the resection of a piece of carcinomatous stomach there is only a bold step to be taken." That bold step he himself ventured and four years later he reported the first successful pylorectomy. Rydygier and Grieg Smith credited Merrem with first conceiving and carrying out this operation on dogs. J. M. T. Finney was of the opinion that due credit must go to an early American surgeon, John T. Jones. The inapplicability of these operations to the human body at that time was fully realized; indeed, little that was immediately practical came from these endeavors. In 1874, however, Gussenbauer and Winiwarter repeated these animal experiments successfully. With thoroughness they reviewed the material seen at necropsy in Vienna from 1817 to 1875. They pointed out the frequent occurrence of small, resectable pyloric carcinomas which Rydygier considered of fundamental importance. Péan was aware of these experiments also when he unsuccessfully carried out pylorectomy in 1879, as was Rydygier who made a similar attempt in 1880. Rydygier noted two essentials for success: (1) early stage of the disease and (2) a safe operative technic.

To Billroth and his pupils, Czerny, Gussenbauer, Winiwarter, von Mikulicz, von Eiselsberg, Wölfler, and others, gastrointestinal surgery is greatly indebted. The tremendous impact of Billroth's school on surgery became increasingly apparent as the years went by. Gastric resections became almost commonplace. When Kocher, in 1893, reviewed gastric surgery as of that period and lucidly established a number of important concepts, the ideas were not his but actually those of Billroth and his pupils.

By 1891 Billroth had done forty-one pyloric resections with sixteen deaths; twenty-nine of these resections were for cancer. Kocher emphasized the importance of experience. For Billroth and his pupils the mortality approximated 56 per cent in resections for cancer. For other surgeons the mortality was much higher. Wölfler had indicated, meanwhile, the variations of mortality due to fixation of the lesion. Similar criteria definitely affected mortality rates today in resections for cancer of the stomach:

	Mortality, Per Cent
Small carcinoma without adhesions...	35
Small carcinoma with few adhesions..	64
Large adherent carcinoma.....	91

Some improvement of these figures quoted by Wölfler has occurred but the various ratios still obtain. Early diagnosis and resection of small lesions give the best results in treatment of cancer of the stomach.

The effect of these surgical inroads on previously unmanageable disease is startling. Resection of the stomach became bolder and bolder. Billroth's first technic (gastroduodenostomy) permitted removal of two-thirds or more of the stomach. The Billroth II operation, following Wölfler's invention of gastroenterostomy, permitted even more extensive resection. The development of a procedure for total resection of the stomach was inevitable. Kaiser, in Czerny's Clinic (1876), had performed total gastrectomy on a dog. This dog lived many years and its digestion was studied by the famous physiologist, Ludwig. At his request the dog was killed in 1882. Schlatter claimed that a small piece of cardia was found remaining. Krönlein maintained that the assertion that total gastrectomy had been performed could be rightfully made only if esophageal and duodenal tissue were at the ends of the specimen removed. Schlatter, in 1897, successfully removed the entire stomach. His patient was a fifty-six year old woman who lived fourteen months. Ribbert established histologic confirmation of the completeness of gastrectomy in accordance with the dictum of Krönlein. Successful total gastrectomy, although it was first attempted in America by Phineas Conner of Cincinnati, in 1884, is still a feat difficult to accomplish.

The impetus of Billroth's school carried it far into intricate abdominal surgery.

Refinements were introduced rapidly. Von Hacker, in 1885, advocated posterior gastroenterostomy. The development of gastroenterostomy was on an obviously mechanical basis. The first gastroenterostomy in America is credited to Ransohoff of Cincinnati (1884). W. J. Mayo, however, early emphasized the importance of the drainage principle of gastroenterostomy and he first aroused the enthusiasm of American surgeons for this operation. His reports before the American Surgical Association, from 1900 to 1905, were masterful expositions of the technic and value of this operative procedure. As Maes has said, "There is nothing speculative about the tributes to the worth of the operation which the Fellow of The American Surgical Association uttered at the meeting in 1905." At that time W. J. Mayo was able to report 307 gastroenterostomies for benign disease with nineteen deaths, a mortality of 6.4 per cent. He had had only one fatality in the last eighty cases. The evolution of the modern technic of gastroenterostomy is well depicted in this report. In the cases outlined, the Murphy button was used 157 times, the posterior suture method 128 times. In May of 1901 Mayo-Robson advocated use of the bone bobbin. In October, 1903, C. H. Mayo did the first short (no loop) gastroenterostomy. Moynihan developed his clamp method about the same time. With all the methods then available, the suture and clamp method was concluded to be best. By 1905 the suture method and posterior short loop gastroenterostomy became routine technics. Thus ended an era of twenty-five years of rapid surgical progress. The mechanical contrivances and ingenious devices of J. B. Murphy and others were relegated to an honored corner on the surgeon's shelf. They had served, nevertheless, the purpose of providing the pioneering surgeon with a fairly safe and rapid method of anastomosis.

This formative period of surgery contained the foundations for many other abdominal operations. Langenbeck, in 1882, had already done the first cholecystectomy and Ohage (1887) did the first cholecystectomy in America. The surgery of diseases of the biliary tract, pancreas and intestine made almost as great strides as did gastric surgery. Cholecystenterostomy was already being done. Winiwarter, whose contributions to experimental gastric surgery were the foundations for Billroth's work, had anastomosed the gallbladder to the colon. W. J. Mayo had reported a case of cholecystenterostomy, with the application of the Murphy button, in 1893. Fenger's contributions to knowledge of the pathology of the biliary tract including the ball valve or "floating stone," further hastened the development of this field. W. J. Mayo credited J. Thornton, Mayo-Robson, Robert Abbe and Charles McBurney with providing adequate means for exploring the biliary ducts. McBurney it was who first removed an impacted stone from the ampulla by opening the duodenum. Winiwarter's error in anastomosing the gallbladder to the colon, thus losing much of its effect on digestion, was recognized. Cholecystostomy occupied the attention of the earlier abdominal surgeons. Moynihan advocated its use routinely for chronic interstitial pancreatitis. Kehr, however, demanded more frequent employment of cholecystectomy. He introduced the use of a tube to drain the biliary ducts, a method which is in wide use today (T tube). By 1902 W. J. Mayo predicted: "Cholecystectomy will rapidly gain in favor and will undoubtedly supersede cholecystotomy in a large group of cases." The problem of reconstruction of the bile ducts was soon met. On this subject W. J. Mayo contributed extensively.

Mayo-Robson wrote extensively in the "Lancet" on diseases of the pancreas and to him much credit must be given. Acute pancreatitis had been described in 1879 by Balzer, who had pointed out the association of fat necrosis. The existence of pancreatic calculi was also recognized and five operations for this disease were collected by Mayo-Robson in 1904. Con-

cerning cancer of the pancreas he was pessimistic. Cholecystenterostomy he considered extremely dangerous and he indicated the high mortality rates.

Surgery of the intestinal tract was making similar but slower progress. Lembert's recognition (1826) of the importance of serosal to serosal anastomosis was of vital importance. He attributed the idea to Dupuytren who performed an operation employing such a technic. The whole subject languished until Lister's work made it useful. Then Czerny, Kocher, Mikulicz and Senn revived it. Incarcerated hernia was one of the first catastrophes to which this technic brought relief. The appalling mortality demonstrated by Lockwood (1891) is indicative of the conditions which prevailed just before the present era began. He reviewed forty cases of hernial incarceration in which the bowel was gangrenous. The mortality was such that only four patients recovered. These cases were all seen at St. Bartholomew's Hospital. Kendal Franks, two years later, pointed out the advisability of resection and end-to-end anastomosis of the bowel. Paul introduced his glass tube in colostomies about this time and showed the feasibility of the "double barreled" colostomy. Colostomy itself became a safer procedure. The device of Amussat, who had ingeniously avoided the peritoneal cavity by the lumbar route, was gradually abandoned. Allingham, Reeves and Cripps established inguinal colostomy. "Loop" colostomy over a rod or other device was introduced by Maydl and by Kelsey of New York. Dinnick in his history of colostomy credits Davies Colleys with the idea of exteriorization of the colon when it is the seat of a malignant growth, although priority is usually given to Block (Thorek). Colleys also advocated delayed opening of the bowel—the operation—"a deux temps." Others credited by Dinnick are Ward of Leeds, a colleague of Moynihan, and Nieles of London.

Billroth, in 1876, was first to resect the cecum; after this small tumors of the bowel were resected frequently. The contributions of Block, Paul and Mickulicz were significant, and C. H. Mayo and W. J. Mayo wrote extensively on surgery of the bowel. Indeed, the obstructive features of appendicitis ("chronic") were noted in passing by W. J. Mayo in 1901 in an article on the cecum. Kraske, Nothnagel, Gersuny and others had attacked cancer of the rectum, of which more was written since it was easier to diagnose.

All these contributions took place in a formative period, when abdominal surgery was yet in its infancy. The rapidity with which it reached maturity is evidence of the purpose it fulfilled.

DEVELOPMENTAL PERIOD

By 1905 gastric surgery had an accepted place in the medical scheme. Its efficacy in the treatment of ulcer of the stomach and duodenum was still unestablished. Its need in the treatment of cancer was imperative. W. J. Mayo had already expressed deep concern over the then prevailing custom of admitting patients with carcinoma of the stomach to medical wards. These patients he said should be brought to the early attention of the surgeon, since only his ministrations offered a chance of cure.

At this time roentgen rays came to the rescue of clinical medicine (Mayo). The work of Cannon laid the basis for roentgenologic study of the gastrointestinal tract. Yet it was difficult for physicians to free themselves of the prevailing concept of visceroptosis first championed by Glenard. Actual study of gastric lesions lagged. Hemmeter, in 1905, was apparently first to suggest the use of the roentgen rays for the study of ulcer. The contributions of Cole, Carman and others brought additional light to bear on the diagnosis of ulcer.

The value of roentgen rays was not established without opposition. Holzknecht, who made the first diagnosis of carcinoma of the stomach with the use of roentgen rays, had difficulty in getting the medical

profession to accept his views. Pfahler made the first diagnosis in this country in 1911. Too much cannot be said of the value of roentgen rays in the diagnosis of gastrointestinal lesions. Today roentgen rays rank first in importance, for exponents of their use can diagnose gastrointestinal lesions with considerable accuracy. The introduction of roentgen diagnosis and the effect of surgery on the increased knowledge of the pathology of the gastrointestinal tract were promptly reflected in the increasing frequency of clinically accurate diagnoses.

The surgeons of this period were intensely active, developing new technics and new operations constantly. Of course, clinical medicine benefited greatly from this surgical progress. Diagnoses and symptom complexes of gastrointestinal disorders became more accurate and better understood.

The treatment of peptic ulcer by surgical or medical means has a complicated history. The obstructive features of duodenal ulcer were adequately relieved by gastroenterostomy. Loreta, in 1882, had performed the first pyloroplasty when, in the course of repairing a gastric fistula, he forcibly dilated a constricted pylorus with his finger. Then followed the Heineke-Mikulicz and Jaboulay methods and, in 1902, the method of J. M. T. Finney. Pyloroplasty at first seemed to most surgeons a logical procedure. It maintained the normal continuity of the alimentary tract and permitted excision of the ulcer. At the Mayo Clinic the first pyloroplasty was done in 1893. Only recently has it lost its wide acceptance. In recent years reports from the Mayo Clinic on pyloroplasty indicate a definite decrease in frequency of its employment, to the advantage, it may be added, of partial gastrectomy. The problem of therapy for ulcer of the gastrointestinal tract was summed up succinctly by W. J. Mayo in 1905 before the American Medical Association:

"It is wise to be conservative and to compel each new departure to bring its own proof. What results can surgery show in this field? First, it has demonstrated the clinical frequency of ulcer of the stomach and duodenum, not a *new* thing, because it has been shown for years in the autopsy records; second, it has developed a symptomatology which enables the diagnosis to be made, and has demonstrated the operative curability of ulcer and certain associated disorders. Surgery has brought back to a safe ground a large number of ulcer victims, who, after repeated medical cures, had taken to fakirs, patent-medicine venders, Christian (?) Science (?), or were making the best of their condition and using patent foodless foods and a restricted diet. In doing even this much, surgery has been open to sound criticism, first on the occasional selection of an unfo tunate case for operation, and second, on the occasional unsatisfactory results of operative interference both as to mortality and to permanence of cure. It is the surgeon's duty to overcome this prejudice by furnishing better results."

The surgical treatment of gastric and duodenal ulcer has developed along quite different lines. The treatment of duodenal ulcer was indirect. An attempt was made to divert the food and alkali from the duodenum, with or without excision. Removal of the lesion has always been attempted by the surgeon when confronted with a gastric ulcer. The Madlener operation is the only one, except gastroenterostomy, in which only an indirect surgical attempt is made to cure gastric ulcer. The introduction of medical regimens, and the efforts of Sippy and Hurst have revived faith in medical treatment of peptic ulcer. In recent years the treatment of duodenal ulcer by surgical means has grown less frequent. Nevertheless, the conviction that a certain percentage of gastric ulcers become malignant has prevented a similar decrease in the frequency of operations for gastric ulcer.

The surgical advance, however, has been nonetheless dramatic in the treatment of ulcer. The Pólya modification of the Billroth II operation, and its modifications by

Balfour, Hofmeister and Finsterer are established in present day surgery. Haberer, meanwhile, has championed the Billroth I method, at least until recently, for the treatment of ulcer.

The experimental work of Edkins, Ivy, Dragstedt, and Mann and Williamson and many others must be recognized as contributing immensely to the understanding of ulcer.

Progress in other fields of abdominal surgery was almost as rapid. A. G. Sullivan described a method of "restoring the continuity of the bile ducts." W. J. Mayo reported several cases in which anastomosis of the biliary ducts to the intestinal tract had been done. Moynihan credited Riedel with the first attempt to reconstruct the biliary duct in 1888. Sprengel was the first, however, to accomplish this successfully. Thus the period of surgery of the bile ducts is entirely modern. The first cholecystogastrostomy was done by Gersuny. The Murphy button afforded a rapid method of anastomosis and was widely used in cholecystenterostomy. Halsted mentioned, in 1900, that attempts had been made to reconstruct the bile ducts over tubes. To W. J. Mayo, Eliot credited the first hepaticoduodenostomy (1904). W. J. Mayo reported his method in 1905. The work of Sullivan and Wilms, McArthur, Jacobson, Walton, Eliot, Judd, Douglas and Lahey further advanced this field. Eliot has written a number of thorough reviews of this subject. W. J. Mayo credited Walton with the suggestion that a flap be raised from the duodenum or stomach to aid in making a mucosal lined tube of common duct. During the period from 1905 to 1920, a gradual reversal occurred in the frequency of use of cholecystectomy and cholecystostomy. Cholecystectomy had been termed "absurd" by Lawson Tait and, in 1893, W. J. Mayo had remarked that cholecystectomy "is mainly practised by a few continental surgeons and is not a popular operation." By 1905, however, he was predicting that cholecystectomy would rightly increase in frequency. This reversal in trend gradually augmented. By 1921 Blalock was advocating removal of every diseased gallbladder. The massive study compiled in 1923 by Hotz and Enderlin, who collected 12,144 cases of biliary tract disease, climaxed the period of development in biliary surgery. The next year the development of the Cole-Graham test inaugurated a new era.

The period, 1905 to 1920, witnessed the expansion of splenic surgery. Splenectomy was an ancient procedure, having been performed first by Zacorelli of Palermo in 1549. Dorsey, of Ohio, removed a malarial spleen in 1855 with great benefit to the patient. Splenectomy had been done in 1881 for Banti's disease, in 1896 for Gaucher's disease and in 1906 for hemolytic jaundice. Rydygier had advocated splenopexy for wandering spleen in 1895. W. J. Mayo contributed largely to surgery of the spleen and described a technic for mobilizing the spleen which greatly reduced the bleeding. Bevan, in 1897, had advocated a new type of incision which is still considered most useful. McCoy reported that 160 cases in which splenectomy had been performed for rupture of the spleen had been recorded up to 1908. The relationship between the spleen and diseases of the blood was being investigated in several directions. Splenectomy was even being advocated for pernicious anemia. In 1912, W. J. Mayo advised splenectomy for splenic anemia because he believed that the enlarged spleen was contributing to the reduction in "the number and value of the red blood corpuscles and low hemoglobin." Kaznelson performed splenectomy specifically for thrombocytopenic purpura in 1916. The reduction in platelets associated with this disease had been reported by Denys in 1887. Alfred Hess, of New York (1917), independently of Kaznelson, also advocated this procedure on theoretic grounds.

The improved knowledge of the reticuloendothelial system and of hemopoiesis has established a sound basis for splenectomy. Recently splenectomy has been utilized for

bleeding esophageal varices, a technic first suggested by W. J. Mayo.

The use of omentopexy in ascites received considerable attention during this time. Vanderveer, in 1912, contributed an excellent review of the status of omentopexy. The original operation by Talma of Utrecht was devised in 1889 and was reported by Lens in 1892 and by Talma himself in 1898. Meanwhile Drummond and Morison, in 1896, reported "a case of ascites due to cirrhosis of the liver, cured by operation." Frazier, of Philadelphia (1900), and Greenough, of Boston (1902), wrote splendid articles on the subject but failed to arouse enthusiasm. However, by 1906 Sinclair was able to collect reports of 273 cases with about 33 per cent cures. The operation was definitely brought into favor by Maurice Richardson, who called its usefulness to the attention of the Southern Surgical Association. W. J. Mayo reported twenty-eight cases in which omentopexy had been performed; he modified the operation by drawing omentum into the rectal sheath. Narath previously had advocated fastening the omentum under the skin. The combination of methods by which the omentum is brought in contact with all the layers of the abdominal wall, to afford better collateral circulation ("step operation"), was described by Pemberton (1931).

The history of surgery of the intestinal tract is almost as intricate as that of gastric surgery. Here, too, great advances were made in the first decade of this period. Oscar Block, of Copenhagen, was apparently first to describe the operation for exteriorization, according to a description in abstract by Thorkild Rovsing which appeared in a German journal in 1892. Block employed colostomy above the site of obstruction in the same loop of exteriorized bowel. Paul, who devised a method of draining the bowel by means of tubes, described his exteriorization operation in 1895. He did not employ the delayed technic. Mikulicz, in 1902, employed all methods; as a result, the operation was named for him. Probably, however, Block and Paul deserve priority credit, and perhaps others as well, as Dinnick has stated.

The progress of surgery of the colon for a time was delayed shortly after these remarkable and widely used procedures were described. The ideas which Glenard had propounded concerning visceroptosis and the neurotic personality were adapted to the treatment of chronic constipation. Famous surgeons wrote extensively on various surgical procedures for chronic constipation. An operation was suggested to repair the ileocecal valve. Enteroanastomosis was performed by others. Removal of the colon was advocated for a variety of disorders. The surgical journals of the period are replete with these articles. Many of these operations are now considered of little value. It would be unwise, however, to state that benefit did not accrue from any of these procedures.

Anastomosis of the bowel has been interestingly surveyed by Kerr. In 1923 he stated that 250 methods of intestinal anastomosis had been reported. The most important contributions were those of Lembert, Murphy and Halsted. Connell, in 1900, reported there were at least 120 methods of intestinal suturing. In 1907, Kerr and Parker found eighty more; they reported an aseptic technic; only one such technic had previously been described. Since then, there had been described twenty-one additional methods of aseptic technic, with the use of clamps, buttons, electrosurgical coagulation and other means.

Rectal cancer is a malignant disease next in frequency to cancer of the stomach. The early history of rectal surgery begins approximately with the development of other forms of abdominal surgery. The following summary is from a recent review by Rankin. Amussat, the first to perform lumbar colostomy was also first to excise the coccyx in the treatment of rectal cancer. Kocher, in 1876, removed part of the sacrum also. Kraske, an assistant of von Volkmann, is established as the greatest

contributor to surgery of the rectum. He advocated (1) radical removal and (2) conservation of the sphincter. In the next twenty-five years Hochenegg, Schelky, DePage, Hartmann, Bardenheuer, Rehn, Rydygier and Billroth made many contributions. The first one-stage combined abdominoperineal operation was performed by Czerny in 1883, and was championed by von Volkmann in 1887. Miles brought the operation into general use; other modifications were reported by Pauchet in France, Lahey in the United States and Grey Turner in England. Two-stage operations were devised by D. F. Jones, Coffey and C. H. Mayo and Rankin. Lahey, in 1930, reported a method of two-stage resection of the rectum or rectosigmoid for carcinoma. Other pioneers in rectal surgery (according to C. H. Mayo) were Kocher, Quénu, Gaudier, Trendelenburg, Abbe and Weir.

In the treatment of intestinal obstruction Treves reduced the mortality one-half by relieving the distended intestine by means of incision, aspiration (Greig Smith) or by the use of Paul's tubes. Broca recommended enterostomy for intestinal obstruction in 1901. The toxemia in intestinal obstruction was attributed by Albeck, in 1901, and Murphy and Brooks, in 1915, to absorption of toxic substances. These ideas command respect today.

Diseases of the peritoneal cavity itself were under investigation from the first. Spencer Wells opened the abdomen for tuberculous peritonitis and found that the exposure brought about significant improvement in the patient's condition. Ochsner reviewed the subject in 1902 before the American Surgical Association and reported that laparotomy and evacuation of the ascitic fluid had a most beneficial effect on tuberculous peritonitis.

Meanwhile a number of miscellaneous diseases and operations were reported. The literature abounds with a variety of incisions for this or that operation. Jackson described his "membranous pericolitis"; Lane, his "kink." The profound anemia associated with operable carcinoma of the cecum and ascending colon was noted by W. J. Mayo and was not regarded as a deterrent to surgery. The knowledge of intestinal wounds which J. B. Murphy had gained in the Haymarket riots grew with the war experience of others. J. B. Murphy died in 1914, leaving behind him numerous valuable contributions and many colorful anecdotes. His button stood the early intestinal surgeons in good stead, only to be abandoned when technic of suturing improved. He was representative and exponent of an era in surgery which has since disappeared.

The first two decades of the twentieth century saw perhaps the greatest possible development in abdominal surgery. In this period the surgery of the West developed. "Modern surgery was brought from Germany to America by many men, foremost among them Nicholas Senn, Christian Fenger, and Arpad Gerster. . . . Fenger left a school of surgery and from him Murphy, Billings and many others in the West received their inspiration. He may be said to be the father of modern surgery in the West" (W. J. Mayo). The period in which these men lived and worked can be called definitely the developmental era of modern abdominal surgery.

AN ERA OF EVALUATION

In the last two decades a more subtle change has been apparent in abdominal surgery. Previously the technics of surgery were still to be modified, new surgical entities were to be described, but the great pioneering work had been accomplished. Surgical approaches to all the organs of the abdomen had been reported and many thousands of procedures devised. Of these, relatively few are used today. The most radical changes occurred in the evaluation of the results of surgery and its effect on the patient. The greatest benefits accruing to surgery came not so much from the perfection of technic as from the introduction of new concepts. The physiologic as well as the pathologic entities involved in the

successful management of abdominal surgery led to the greatest advances. The special attention paid to preoperative and postoperative care induced striking reductions in surgical mortality. Progress, however, continued unabated in all the fields of abdominal surgery.

Crile, in 1923, stated that on a visit to England he had seen Moynihan resect half of the stomach for a duodenal ulcer in an effort to reduce the secretion of gastric acids. This procedure he compared to resection of the thyroid to diminish hyperthyroidism. Finsterer, in 1925, reviewed the subject of gastric resection for the treatment of ulcer. Richter, in 1913 or 1914, had advocated gastroduodenal resection and Billroth II anastomosis for duodenal ulcer. Haberer and Clairmont also advocated resection but favored a Billroth I type of anastomosis. Haberer maintained that such an operation was more in accordance with physiologic knowledge than were others. Finsterer, however, advocated using a method of resection with a Pólya type of anastomosis. He devised his own modification of the Hofmeister-Pólya operation. The great objection that Finsterer raised to Haberer's modification of the Billroth I technic was that the suture line had the tendency to be incompetent. Finsterer also stated that the Pólya type of resection permitted higher resection, that it afforded a greater reduction in acidity than the Billroth I-Haberer technic and, therefore, that it was more efficacious in preventing recurrence. These observations recently have been confirmed by one of us (Walters).

The debate as to the proper operation for duodenal ulcer was strenuous. Among the many operations offered, selection of the proper method is still difficult. Devine, for example, devised an exclusion operation which he recommended for ulcers of certain types; that is, for chronic, calloused ulcers, particularly of women. For these ulcers, various operations are uniformly successful but probably simple gastroenterostomy is best. Other technics were devised by Babcock (1926), and Connell (1929), and recently a method has been described by Wangensteen. The diversity of points of view and the ultimate proof that the ideal in surgery of duodenal ulcer has not yet been attained, can be illustrated by the fact that von Schmieden described a method of resection of the lesser gastric curve rather than gastroenterostomy. Wangensteen, on the contrary, recently has advocated resection of the greater curvature of the stomach, converting it into a tube-like structure.

The number of factors involved in the etiology of peptic ulcer is still undetermined. The contributions of experimental surgeons and physiologists have added much knowledge. In the last fifteen years the trend has been away from surgical management of duodenal ulcer. This tendency can be illustrated by figures from the Mayo Clinic; only 17 per cent of all duodenal ulcers diagnosed at the clinic were treated surgically in 1939. At present the most widely used operations are gastroenterostomy, which still retains a useful place, and partial gastrectomy. In this country, A. A. Berg, Strauss and others advocated the latter operation, which has come to replace in recent years the various plastic procedures on the pylorus.

Of gastric ulcer much remains to be learned. The flexible gastroscope, of which Schindler has been the greatest proponent, has added much to knowledge of this disease. The relation of gastric ulcer to gastric cancer has been definitely established. For this reason gastric ulcer requires careful medical management and frequent observation. In this disease a number of operations are valuable, for instance, partial gastrectomy with Billroth I or Pólya anastomosis, or local excision preferably with gastroenterostomy. A reduction in acidity more frequently follows operations for gastric ulcer than for duodenal ulcer.

Knowledge of gastric cancer is in flux. Recent advances in diagnosis have not materially improved the frequency with which cancer of the stomach is discovered in time to be operable. The recent evalua-

tions of Livingston and Pack should prove a great stimulus to further progress in treating this disease. At the Mayo Clinic, Lewis has reviewed more than 6,000 cases in which operation was performed for gastric cancer. Among the surgical procedures are included nearly 3,000 gastric resections. His conclusions, like those of Pack and Livingston, demonstrate that if the lesion is operable the outlook for the patient with cancer of the stomach is as good as for the patient with cancer of any other internal organ. It is appalling to realize that the patient who presents himself to his physician with cancer of the stomach faces only one chance in twenty to thirty of living five more years. This much may be said: any improvement in the resectability rate of cancer of the stomach is due more to the daring and increased technical capacity of the surgeon than to earlier diagnosis. Cancer of the stomach is a major problem in abdominal surgery and remains a "captain of the men of death," yet to be vanquished.

In surgery of the biliary tract it is now recognized that technical skill and clinical judgment must be combined carefully. Mackey, in a review of cholecystitis, pointed out that biliary surgery prior to the introduction of the Graham-Cole test was practically limited to gallstones and their complications. New avenues of approach were opened with roentgenologic visualization of the gallbladder. Mackey quoted Judd (1927): "The number of operations upon the gallbladder has been greatly increased since the general employment of the Graham-Cole method in making the diagnosis."

The Graham-Cole test raised some new problems. The question of removing the gallbladder in the absence of stones is still being debated. But it is acknowledged that the postoperative results are better if stones were present.

The introduction of tests of hepatic function and the suitable preoperative preparation of patients about to undergo surgical operation on the biliary tract greatly reduced an apparently irreducible mortality (Mayo, Graham).

New methods of diagnosis, treatment and technic are constantly being introduced. The use of vitamins (thiamin chloride), glucose and other measures has greatly aided in restoring hepatic function that has been reduced by associated biliary tract disease. Pribram renewed interest in mucoclasis and carbonization of the gallbladder wall (more recently performed with the electrosurgical unit by Thorek). For removal of stones overlooked in the common duct, Pribram has described a method in which ether has been used successfully to dissolve the stones if a tube has been placed in the duct. To Lahey, who this year is president-elect of the American Medical Association, belongs credit for calling attention to the method by which a biliary fistula can be implanted into the gastrointestinal tract.

The physiology and anatomy of the biliary tract have been studied by Ivy, Boyden, McGowan, Butsch and Walters, and others. Best and Hicken have described biliary dyssynergia, and cholangiography (Mirizzi, Walters and Thiessen, and Best) now has a recognized place in surgery of the biliary tract.

The greatest advance in reducing the risk of operating in the presence of jaundice has been the introduction of vitamin K (Dam, Almquist and Klose, Smith, Warner and Brinkhous and Butt, Snell and Osterberg). Its recent synthesis by Doisy, Fieser and their associates has given the surgeon a strong weapon. The problem of hemorrhage of jaundiced patients was always troublesome. The early literature abounds in descriptions of various methods (calcium, transfusion, etc.) to control hemorrhage in the presence of jaundice. The work in this field affords a striking example of how carefully integrated research and alert clinical interest combined to save many lives.

The treatment of intestinal obstruction was always difficult. It is so today, but the earlier surgeon had many fewer weapons

with which to combat the disease. It was early recognized that relief of distention is important. Dragstedt and his associates, in 1917, found that the so-called closed intestinal loop was lethal to dogs in a short time. Haden and Orr, in 1923, reported the ability to keep dogs with pyloric obstruction alive by giving infusions of salt solution, and Gamble and Ross showed, in 1925, that death from pyloric obstruction was due to a loss of sodium chloride.

Hausler and Foster (1924) recognized the pathologic and lethal factors which distinguished simple acute intestinal obstruction from strangulated obstruction. J. B. Murphy long ago had pointed out the hyperemia of the obstructed small intestine ("black death") due to venous rather than arterial obstruction ("white death").

Robertson Ward (1925) described an apparatus for continuous gastric and duodenal lavage. Wangensteen clearly established the physiologic basis for intestinal decompression by suction (1933). The enthusiasm with which this work has been accepted is convincing evidence of its value and efficacy in the treatment of intestinal obstruction.

Abbott and Johnston further modified intestinal suction by using the longer tube described by Miller and Abbott. Coller and Maddock have contributed extensively to the studies of fluid and electrolyte balance. More recently Fine and his associates have emphasized the value of high concentrations of oxygen in the treatment of intestinal distention. The mask invented by Boothby, Lovelace and Bulbulian has likewise proved of value in administering regulated high concentrations of oxygen.

Ravdin and Johnston, in a recent review, pointed out that with a single exception (Wangensteen) a definite decrease in morbidity and mortality has not followed the newer knowledge of the physiology of the obstructed intestine. However, the introduction of suction and adequate replacement of fluid has probably been too recent to permit publication of large series of observations. Apparently, careful selection and individualization of treatment will yield good results in the future.

The maintenance of proper fluid and electrolyte balance is an essential recognized by every surgeon. The ease with which unbalance can occur is especially familiar to abdominal surgeons. The tremendous gain which surgery has made through the advances of biochemistry can hardly be estimated. The many methods of parenteral support afforded the surgeon by the use of blood transfusion, infusions of saline solution and other electrolytes, have aided materially in preoperative and postoperative care. More recently the protein deficiencies have been recognized and infusion of plasma, whole blood, serum and amino-acid solutions have been suggested. The paramount interest in preoperative and postoperative care is well illustrated by this year's meeting of the American Surgical Association. Too much cannot be said in praise of the newer adjuncts to postoperative care. The use of oxygen, and at first serum, but now chemotherapy, in the treatment of pneumonia has made this disease a less dreaded postoperative complication than formerly. The problem of pulmonary embolism, insoluble despite Trendelenburg's heroic procedure, is apparently giving way to the newer knowledge and the use of heparin. The treatment of infection by means of the various new "sulfa" compounds is so new and glowing a chapter in medical and surgical history as to beggar description.

The present situation in regard to appendicitis is not satisfactory. Morse and Rader have reviewed the subject for the last twenty years. More than twenty years ago Murphy decried the apparent increase in mortality from acute appendicitis. According to the bureau of vital statistics there were nine deaths in each 100,000 from appendicitis in 1920 and 14.3 in each 100,000 in 1934. In their collected review of 73,000 cases a gross mortality of 4.89 per cent is cited. These are case series reported

in the literature and they feel that the average mortality rate in the United States is more than 10 per cent.

With all these problems new surgical entities constantly arise. The discovery of insulin was of great value to surgery as it was to all branches of medical practice. Shortly after the discovery and use of insulin, the concept of hyperinsulinism was advanced (Seale Harris, 1924). The first islet carcinoma, with hyperinsulinism, was reported by Wilder and associates. Adenomas of the islands of Langerhans have been removed, with cessation of symptoms, by a number of surgeons (Graham [1929], Howland, Whipple, Holman, Walters, and others). Holman (1929) suggested the term "pancreisles" for the islands of Langerhans because much was to be written of them in the future.

The treatment of cancer of the pancreas, an almost hopeless surgical problem, has received renewed attention through the work of Brunschwig, Whipple and others.

Surgery of the spleen is undergoing constant evaluation. The introduction of liver therapy for pernicious anemia and the better understanding of hematology have put the surgery of the spleen on a firmer basis. Present indications for splenectomy are based on a better classification of hemorrhagic diseases (Wintrobe, Whipple). In these diseases greatest progress has been made. Pemberton has reported good results (83 per cent of cures) from splenectomy for hemolytic jaundice, as well as for thrombocytopenic purpura. In splenic anemia the separation of a number of obscure syndromes and the knowledge of liver function available through various new tests have improved results. An accurate diagnosis is important; lack of this accounts for a number of failures following splenectomy.

The concept of regional ileitis introduced by Crohn and Ginzburg is a relatively recent addition to the field of intestinal surgery. To the manner of anastomosis of the intestinal tract many men have made contributions. Various devices, clamps, tubes and instruments of all descriptions have been invented by men of ingenuity. Operations of one-stage and of multiple-stages for colonic resection come and go in favor. Yet with all the variety of methods and means, definite order is appearing. Careful statistical studies are bringing to surgery of cancer of the colon the same clear insight that is beginning to appear in surgery of cancer of the stomach.

We shall not prophesy with the surgeon of sixty years ago, quoted by Harvey Graham, that abdominal surgery has reached an end in its development. It remains, as always, a fruitful and vast panorama in which new discoveries are constantly unfolding new vistas.

We have quoted extensively from the work of many men, but especially have we drawn on the frequent contributions of the late Dr. W. J. Mayo. His career exemplified the era we have tried to picture. His writings were diversified, thorough and brimful of great common sense. From a perusal of his articles it is possible to relive an era of abdominal surgery in its hey-dey of new discovery.

PROGRESS IN OBSTETRICS: 1890–1940

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THAT the past half century has brought achievements of permanent value to obstetrics, measurable already by a beneficent saving in human life and happiness, is common knowledge. A glance at these achievements reveals three salient facts: first, that they have been won by the efforts of a large number of very diverse persons—talented investigators, skilled clinicians and devoted crusaders; second, that these efforts have been furthered by an awakened interest on the part of national governments, our own and others, in maternal welfare as a major social problem; third, that our progress, though great in sum, has been made not by spectacular leaps but little by little along the lines of evolution rather than revolution.

So large a group of workers, scientific, clinical and social, has participated in the advance of obstetrics that it is impractical in a relatively brief sketch to mention any fair proportion of those deserving specific credit. To avoid all risk of unjust discrimination, this review will deal impersonally with underlying principles and significant innovations in practice. Make no mistake, however; among those benefactors who could be named are some destined for a permanent place in medical annals. Impressive testimony to the extent and variety of the work now going on is the output of contemporary publications. The Quarterly Cumulative Index for 1939 listed almost two thousand items under the headings *obstetrics, pregnancy, labor, puerperium, puerperal infection, obstetrical textbooks, nursing* and *hospitals.*

The first evidence of the interest of our own government in the protection of motherhood was the publication in 1913 by the Children's Bureau of a free handbook on prenatal care. Shortly thereafter Congress gave financial support to those states that wished to supervise the health of pregnant women in medically backward districts; and an initial appropriation, relatively small, was from time to time increased until the Federal Government and the states together now employ three thousand doctors and nurses and expend annually as much as four million dollars for maternal and infant welfare.

An outstanding characteristic of the half century has been the intrinsic research carried on with the help of laboratory methods—the logical development of a rich clinical heritage. Consider, for example, the subject of puerperal infection. Its contagiousness was proved to the letter by three or four men a hundred years ago and their conclusions quickly wrought revolutionary changes in the practice of midwifery. Our times, too, have witnessed remarkable discoveries pertaining to bacteria that penetrate the puerperal uterus as well as to means for defeating the invaders. But our headway has been deliberate, one step showing us how to take another, and the work has been shared by many, many patient but imaginative toilers. Progress of the kind that has thus elaborated the chapter on puerperal infection seems to me typical of our gains in both the science and the art of obstetrics in the last two generations. What shall we call this quiet orderly process if not evolution?

This attitude of widespread cooperation and scientific thoroughness is admirably illustrated by the cautious acceptance of new methods of anesthesia.

ANALGESIA AND AMNESIA

It was natural that inhalation anesthesia, an epoch-making discovery of the nineteenth century, should be applied to the

pain of childbirth. Such anesthesia, induced with ether, chloroform or nitrous oxide, completely relieves the mother of pain during the expulsive stage of labor. But the administration of these drugs to obstetrical patients must not be prolonged. Otherwise serious complications, such as anoxemia, degeneration of the liver, kidneys or heart muscle are invited. Momentous objections also hold against protracted anesthesia with ethylene, cyclopropane and vinyl ether. Consequently, search has been directed elsewhere for efficient agents to abolish pain during the stage of cervical dilatation.

Failing the abolition of pain, treatment has striven to blot out the memory of it. In 1902, some success in this effort was attained in Germany with "twilight sleep." A decade later an animated campaign to proclaim its merits among the laity got under way in this country. To its use the medical profession raised objections and various modifications of the method were devised. One modification after another was presented as a panacea. Discussion of these procedures ranked high in the agenda of medical societies which invariably reached a Scotch verdict. All fell short in the hands of unprejudiced observers.

Quick to try anything that promised to lift the curse of Eve, obstetricians did not hesitate to employ drugs admittedly dangerous. As might have been expected, regrettable experiences were encountered and communicated to medical journals but received little if any notice in newspapers and popular magazines. Narcotics are administered to parturients orally, rectally, subcutaneously, or intravenously. The drugs that are used include barbiturates, paraldehyde, opiates, scopolamine, avertin, alcohol, ether—not to name them all. Each has strong advocates and bitter opponents. Apart from minor and occasional complications the most undesirable effects are restlessness of the mother and asphyxia of the infant. Which method is best, which the worst, none will attempt to say unless strongly partisan. But on one point agreement is wellnigh unanimous; that is, that current procedures have merely a temporary significance, for they represent a passing phase of the struggle for ideal obstetrical analgesia—the relief of suffering without hindrance to labor or damage to the child.

EMANCIPATION FROM MIDWIFERY

Fifty years ago the branch of medicine that deals with parturition in human beings was called midwifery. In country districts like that in which my father practised, physicians took pride in conducting a delivery without lifting the bed clothes. Not to expose the mother helped to answer arguments against the presence of a man on such an occasion. In keeping with the attitude of the public in both town and city, medical schools still retained the designation *professor of midwifery* and teachers wrote textbooks on *the practice of midwifery*.

Twenty-five years later epochal changes had come about. Microscopic studies together with chemical research in the physiology of pregnancy put a new face upon the problems of parturition, its antecedents and its consequences. Capable workers, multiplying in number year by year, broadened and emphasized the fundamental principles of midwifery by first-rate contributions to the scientific aspects of reproduction in animals and human beings. How great their opportunity was is illustrated by an interview (1915) with the head of an obstetrical department in a well known university. Asked what he thought were the reasons for the success of his career he snapped: "Research! Research in tissue pathology and in bacteriology. Why, in the time since I became a doctor one had only to look through a microscope to make a discovery." Many questions were at hand and the answers fell like ripe fruit into the lap of investigators when new methods of inquiry shook the tree of knowledge.

The result of all this was inevitable. Academic appreciation of the rightful place of obstetrics in medical science and in the medical curriculum dignified everywhere

the position of physicians who supervised childbirth. The expression, *man-midwife*, became obsolete. Obstetrics had shaken off its shackles.

THE MICROSCOPE

The magnification of tissues cut in thin sections and stained with differentiating dyes removed innumerable obstacles to a correct understanding of human physiology and pathology. The discoveries which came thick and fast paved the way for new fashions in clinical medicine; and obstetrics felt the influence, not only of investigations in its own field but also of those pursued in allied subjects. More definite knowledge of embryonic development, for example, prompted fresh concepts of the placenta, membranes and amniotic fluid. Some of the phenomena with clear clinical import thus brought to light in the borderland between embryology and obstetrics are the following:

(1) The mechanism of implantation after the fertilized ovum has reached the uterus. (2) Phenomena associated with ectopic gestation, especially the distinction between tubal abortion and tubal rupture. (3) The possibility of fertilization before the ovum leaves the ovary. (4) The interrelationship of decidual disease, congenital deformity of the embryo and spontaneous abortion—oldest of eugenic devices. (5) The grafting of a portion of one embryo upon the body of another. (6) The successful transplantation of ovarian tissue. (7) Amniotic adhesions, an etiologic factor in the development of anencephalus and of spina bifida. (8) The role of the chromosomes in the mechanism of heredity. (9) The fixing of responsibility for sex determination upon the spermatozoa. (10) Exposure of the fallacy of "maternal impressions" by intimate study of pathologic embryos.

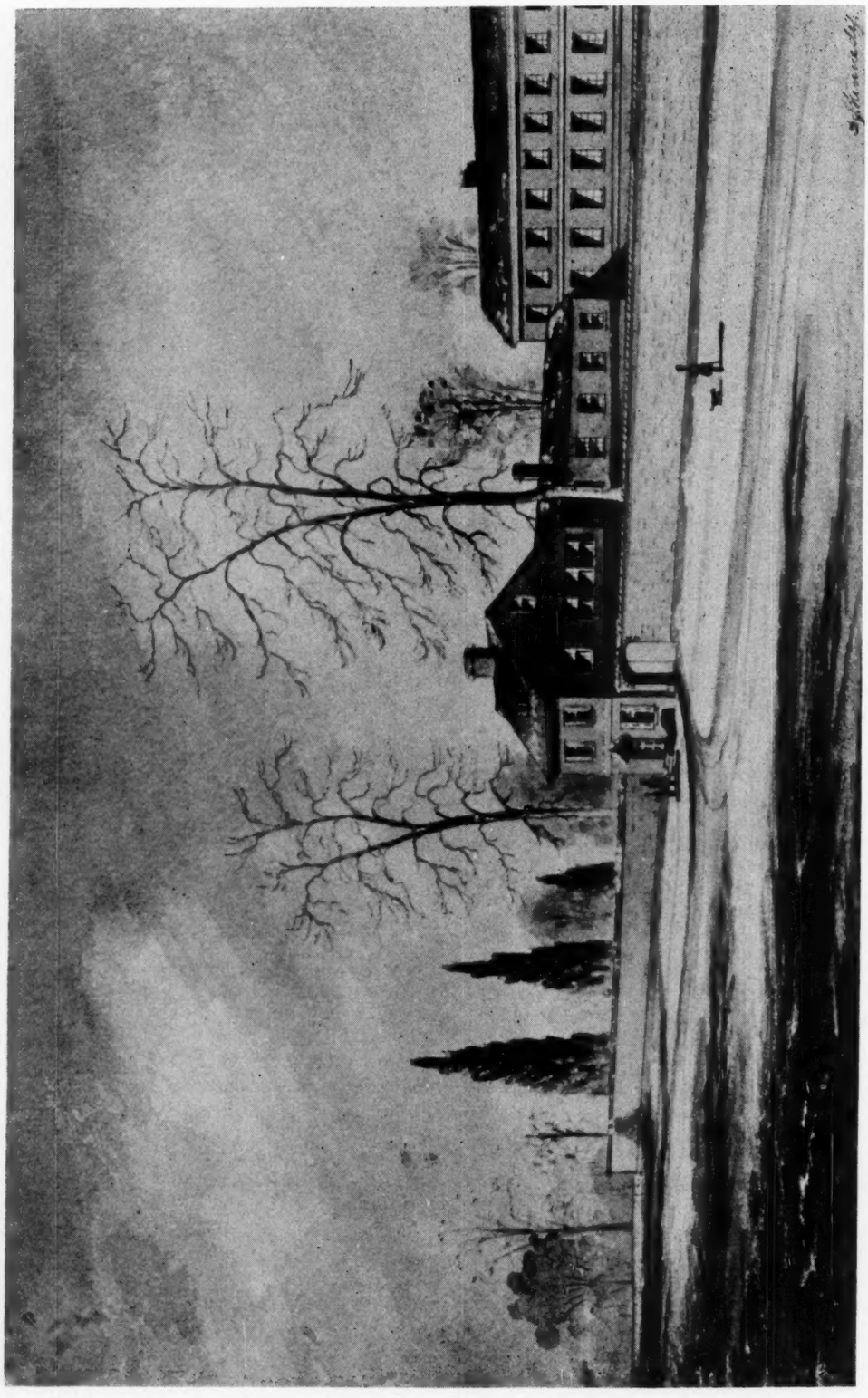
Placentation, now that the story is told directly, has become less perplexing. No longer are students taught human embryology in terms of the chick—deceptive pedagogic strategy. Material gathered from operating room and clinic depicts what happens to our own species. Of these observations the most extensive relate to the placenta, and beyond the salient features are findings of interest to the specialist alone.

Foremost in importance is the *trophoblast*, the peripheral zone of a recently fertilized ovum which penetrates the uterine mucosa, opens maternal blood vessels and establishes the metabolic interchange between embryo and host. Ordinarily, the trophoblast provides exquisitely arranged epithelial layers to cover the chorionic villi; but occasionally its wild and profuse growth gives rise to an anomaly, *hydatidiform mole* (1895). As the character of the growth is benign in four-fifths of the cases, no excuse exists for hysterectomy routinely. Evacuation of the contents of the uterus suffices. Conservatism has the support of a postoperative follow-up with repeated tests for gonadotropic hormones in the urine, enabling the surgeon to act promptly whenever the laboratory reports a positive reaction.

Chorionepithelioma, likewise a trophoblastic tumor (1895), may either be a sequel to mole or of independent origin. Here again, the hormone urine test has utmost value as a diagnostic and therapeutic guide. Axiomatically the tumor necessitates panhysterectomy. Even so radical a procedure effects cure only if hurriedly undertaken, for the growth metastasizes with shocking speed.

Eclampsia. The pathogenesis of this "disease of theories" was once believed to hinge upon the placenta. In 1893, small trophoblastic emboli, found in the lungs of women who died in eclamptic convulsions, were thought to have etiologic significance. Later it was shown that the emboli were not the cause but the result of convulsions.

Accurate description of the lesions (1902) assigned the characteristic pathologic manifestations of eclampsia to five organs. These manifestations include degenerative changes in the kidneys and heart muscle, edema in the lungs and brain, often hemorrhage in the latter organ, and most intimate



Philadelphia Almshouse (Philadelphia General Hospital)—1732

Sketched by Birch in 1798 and Copied by D. J. Kennedy

of all, peripheral necrosis of the liver lobule beginning in the periportal spaces. After four decades of experiment the lesions have been reproduced in animals, the technic employed being ligature of both renal arteries (1939). Although attempts to fix the responsibility for eclampsia upon the placenta have thus far proved unsuccessful, an appreciable amount of investigation continues to support the hypothesis that this organ is implicated in the intoxication.

Syphilis. The treponema pallida (1905) has been demonstrated in the placenta after meticulous search. Gummata there rank as curiosities, nothing more. However, there are pathognomonic syphilitic changes in the organ, including gross and microscopic lesions. The placenta is larger than normal, very much larger in relation to the weight of the undernourished fetus, alive or dead. Clubbing of the chorionic villi, the specific placental lesion, became insignificant from a practical standpoint in 1907, when the serologic test took its place. In the course of gestation, if the blood test be found positive, arsenical treatment of the mother protects her offspring as well as herself (1910). As yet, the feasibility of rapid cure of syphilis during pregnancy by the continuous intravenous drip administration of organic arsenicals in solution has not been certified. Small repeated doses have been followed in 90 per cent of the cases by the birth of an infant free of syphilitic manifestations. If arsenical treatment is begun before the fifth month of pregnancy and supplemented with intramuscular injections of bismuth, the chances in favor of a healthy infant at birth are perceptibly increased, approaching 95 per cent.

REFORMATION IN ANTENATAL SUPERVISION

The supervision of pregnancy which eminent obstetricians considered adequate three decades ago seems to us strangely meager and casual. In the very best tradition, the doctor assumed responsibility at a consultation early in pregnancy. At that time a short history was taken, a vaginal examination made and instructions given to submit specimens of urine at definite intervals. A printed list of untoward symptoms was put into the patient's hands with the counsel to report these or anything else that disturbed her peace of mind.

No appointment was made for a subsequent visit to the doctor's office. The next formal consultation occurred when, approximately a month before the expected confinement, the physician called at the patient's home. Then he measured the pelvis, determined the position of the fetus by abdominal palpation, listened to the fetal heart and tried to answer such questions as he was asked. One purpose of the visit was to select in the home a room suited to the conduct of labor. Another was to settle arrangements for the nurse, including the date when her pay should begin, to provide for the equipment likely to be needed and to tell the patient what to do when help should be wanted. The troublesome details discussed at this second and last conference have now been largely eliminated by the willingness of women to enter a hospital for obstetrical attention—the most radical transformation of practice since the turn of the twentieth century.

The old antenatal régime afforded the doctor little chance to learn what was happening to his patient. Aside from urinalysis his only instrument of precision was the telephone. Complications took everyone by surprise and had to be dealt with as emergencies. The opportunity to try prophylactic treatment was wholly lost; and curative measures, when employed, were often too late.

These dangers and penalties contemporary practice seeks to avoid by a type of supervision that calls for constant cooperation between the patient and doctor. For the prospective mother it is education in a proper way of life. For the doctor it is the provision of essential knowledge by means of observations never less than once a month and at shorter intervals near term. From these frequent conferences he can so integrate symptoms and objective findings

as to know whether or not pregnancy is progressing normally.

National concern about prenatal care was manifested long before the end of the last century in France, where there was grave concern about the falling birth rate. Social agencies undertook remedial measures among the less well-to-do. At first their efforts did not go very far. The initial consultation aimed to detect evidence of tuberculosis, severe grades of anemia, cardiac maladies, renal affections, venereal disease, diabetes or any other chronic derangement. Subsequent supervision—dietetic, hygienic, sanitary—was entrusted to a nurse, who reported to the physician when extraordinary symptoms appeared or special treatment was required. From this simple start, prenatal care has spread far and wide since 1901.

Pre-eclamptic Toxemia. At present observations made from time to time in the doctor's office afford protection, of great value even though not absolute, against serious types of toxemia during pregnancy. In the main these tests relate to the weight, the urine and the blood pressure.

The use of weighing scales has a significance out of all proportion to the cost and trouble. They serve as a guide in regulating the diet, which provides the only means we have, though far from perfect, of preventing overgrowth of the fetus. Laying emphasis upon limiting the gain in weight impresses on the patient her responsibility for carrying out with fidelity the other directions the doctor gives. Of the greatest importance is the fact that, since edema of the tissues weighs heavily, the scales can announce the approach of toxemia.

Albuminuria, although recognized as early as 1843 as an alarming complication of pregnancy, has been looked for much more consistently during the past fifty years. Nowadays, specimens of urine are submitted every two weeks. If even a very faint trace of albumin appears, analyses are made more often. When the amount of albumin is measurable, tests are made every day. In the presence of toxemia, the patient records the amount of urine passed within twenty-four hours, since this is frequently an excellent criterion of renal efficiency.

Estimation of blood pressure (1901) time and again gives the initial clue to the mysterious approach of eclampsia, enabling the physician to prescribe a diet and rest in bed while these simple measures may still be curative. If hygienic regimentation fails, additional treatment will be required, and the prevailing degree of arterial hypertension remains a substantial therapeutic guide.

Though the problems of clinicians present so many variables that strict adherence to arbitrary rules cannot be expected, it is possible to illustrate the prognostic value of elevations in blood pressure by a schedule that obstetricians have found useful. Whenever the systolic blood pressure reaches 140 mm. of Hg., continuous bed rest at home is ordered; at 150 mm. the patient enters the hospital for closer supervision, for intravenous therapy or for other treatment; a blood pressure of 160 mm. prompts discussion of terminating pregnancy. Should hypertension continue to increase, termination becomes urgent in anticipation of convulsions.

Deaths from eclampsia and allied states account for one-fourth of the maternal mortality in the United States, a total of 2,521 women having thus lost their lives in 1938. Terrible as that may be, the death rate was formerly higher. The steady improvement, everyone agrees, has been the result of closer prenatal supervision.

Search for the cause of eclampsia has followed many leads. Much of the research during the past fifty years has been chemical—analysis of the urine, blood, sweat, gases expired from the lungs and even of the placenta and other vital organs. Although such research has revealed facts of utmost importance to pathologic physiology, it has not disclosed the specific cause of this complication. It is no wonder, therefore, that investigators seize avidly upon every new instrument science offers for the

study of disease and apply it to the problems of the toxemias of pregnancy. At the moment the endocrines are on trial. Eminent authorities have suspected (with what promise who can say?) the anterior lobe of the pituitary gland as the provocative agent of eclampsia.

In general the results of prenatal care have improved with each advance in *internal medicine*. Uppermost among recent benefits reflected from that source are the use of insulin in diabetes, vitamins to correct dietary deficiencies, liver and iron to combat anemia and chemotherapeutic agents in the management of pyelitis. With respect to the last complication the place of ureteral catheterization during pregnancy continues to be a subject of debate.

THE LURE OF THE ENDOCRINES

No field of medicine as fascinating as endocrinology has come under cultivation in our time. A remarkable start on the laboratory side prompted clinicians—eager, as they should be, for remedies—to put into immediate practice rudimentary, unoriented knowledge. Of necessity the result of indiscriminate treatment, unchecked and prematurely announced, was confusion; but this confusion did not obscure the brilliant work being done by competent investigators.

To canvass the endocrines thoroughly is beyond my province, for the task assigned to me is a survey of significant contributions to obstetrics. Arbitrarily excluded, therefore, are facts relating to puberty, to the menopause and to gynecologic problems in women of childbearing age. The restriction does not, however, apply to hormone studies that have clarified vital aspects of gestation. Moreover, an appreciation of what has been achieved in obstetrics requires something of background and justifies reference to endocrine research elsewhere. It is pertinent to note that identical sex hormones have been shown to prevail in both men and women and that quantitative sexual variations are characteristic. A distorted concentration of hormones calls forth masculine traits in women, effeminate traits in men. The anterior pituitary has been accepted as the master gland in the production of sex hormones, but the adrenal cortex also plays a prominent role. Since hormones derived from the anterior pituitary stimulate the gonads, both ovary and testis, a descriptive name, gonadotropic, aptly fits the group.

Gonadotropic hormones elaborated by the chorionic villi and excreted through the urine afford a means of diagnosis of pregnancy in the early weeks. The simply executed test produces a reaction apparent to the unaided eye. By the most convenient method, the urine is injected into an ear vein of a doe rabbit suitable for the experiment. If the woman who submits the urine is pregnant, the rabbit's ovaries will, within forty-eight hours, exhibit a profusion of ripening ova with hemorrhage into the follicles. There is a positive reaction in 98 per cent of normal pregnancies and a negative in the same percentage of women not pregnant.

Repetition of this test corrects the very exceptional false report, unless it pertains to missed abortion or to ectopic gestation. As the production of chorionic gonadotropic hormones ceases whenever hemorrhage breaks the placental attachment, this accident vitiates the urine test in tubal pregnancy. On the other hand, hydatidiform mole and chorionepithelioma produce an unusually large amount of gonadotropic hormones; and in consequence the ovarian reaction becomes exceedingly strong. Measurement of its intensity has, however, thus far proved of no practical value.

Estrogenic hormones are related to and may be derived from cholesterol. Indeed cholesterol is the artificial source of certain potent synthetic preparations of estrogen. Its natural sources include the thecal and possibly the granulosa cells of the ovarian follicles, the amniotic fluid, the adrenal cortex and the testis.

Not until 1896, when successful transplantation of ovarian tissue established the

fact, was there confirmation of the age-old suspicion that the ovaries pour a secretion into the blood stream. Since that accomplishment, how rapid the strides in therapy! At the drug store today under the label *estrogen*, or of some name coined to protect commercial rights, female sex hormone is offered for sale.

After estrogenic substances were demonstrated in the blood (1925) and in the urine (1927), less direct ways were found of following their varying concentration in the body, namely, by biopsy of the endometrium and of the vaginal mucosa and by counting the cells in smears from the vaginal secretion.

Upon the ovaries this hormone has no effect whatever, but it exerts powerful influences upon other sexual organs, primary and secondary, stimulating the growth of the vaginal epithelium, of the uterine musculature and of the mammary glands. Presumably it sensitizes the myometrium to the action of the posterior pituitary oxytocic hormone, laying the groundwork for labor. As term draws near the inactive form of estrogen in the maternal circulation diminishes and the active form increases.

Corpus Luteum Hormone. Not long after operations upon the pelvic organs came to be performed in the presence of an early pregnancy, gynecologists noticed that abortion followed the removal of both ovaries and sometimes of one only. The relationship of cause and effect was defined exquisitely if abortion followed the simple ablation of the corpus luteum. Animal experimentation (1897) and additional clinical observations confirmed the essential character of the contribution of the corpus luteum toward the firm attachment of the early placenta, certainly for two or three months. The responsible hormone, progesterone, has been isolated, its lipoid constitution established and even its synthesis effected.

Our clear-cut knowledge of the origin, chemistry and functions of progesterone contrasts sharply with the somewhat hazy information at hand regarding other hormones. Derived mainly, if not exclusively, from the corpus luteum, progesterone inaugurates the preparation of the endometrium for the reception of the fertilized ovum, expedites its implantation, and adapts the maternal tissues to the nutrition of the embryo. Recognition of these facts, as well as of its inhibitory influence upon uterine contractions, inspired the administration of progesterone in cases of threatened or habitual abortion, and promising results have already been reported. Welcome though these are, we remember that enthusiasts recommend vitamin E for the same purpose. Furthermore, the association of abortion with endometritis attributable to the gonococcus has been recognized since the closing years of the last century.

Rhythm. In 1909, the histologic alterations in the endometrium before, during and after menstruation were accurately described; but not until 1915 was attention focused upon learning how nature synchronizes the uterine and ovarian cycles of healthy women. Even so, twenty years more elapsed before the secret was disclosed. Help toward understanding the two timetables came through the measuring of fluctuations in the blood content of estrogen and, by taking calendar dates as criteria, through comparing the curve thus obtained with the rhythmic changes in the uterine mucous membrane each month. A pivotal observation was made in 1928 at the operating table when the surgeon discovered a normal ovum, freshly extruded from the ovary, in transit through the fallopian tube.

This discovery, along with supplementary observations, indicates that ovulation occurs anywhere from twelve to eighteen days before the onset of menstruation. During that period, in the case of women exhibiting the twenty-eight day menstrual cycle, coitus is apt to be fruitful. At other times, as a rule, temporary sterility prevails because of the lack of a ripe ovum. But an absolutely "safe period" can never be predicted, for successive ovulatory cycles vary notably. Upon occasion, unanticipated

deviations in rhythm defeat impartially both attempts to escape conception and efforts to plan a pregnancy that shall begin and end at set seasons.

HEMORRHAGE: ANTEPARTUM AND POSTPARTUM

Hemorrhage now heads the list of puerperal mortality rates. Progress in dealing with this accident has been slower than in the case of toxemia and of infection. To be sure, prenatal supervision affords the opportunity to control hemorrhage promptly when it is encountered during pregnancy. Obstetricians have learned that if absolute rest and generous sedation fail, emptying the uterus is a conservative and not a radical procedure. Among other beneficial agencies, intravenous therapy—saline solution, glucose, and especially blood transfusion—ranks high. Delay in securing a donor is obviated by the blood-banks which are already standard equipment in large hospitals and certain of wider adoption. The maintenance of such facilities is of special importance to obstetrical patients, because they are prone to hemorrhage. Although such patients are partially equipped to withstand the complication, since at term the volume of blood has increased 25 per cent, even moderate bleeding is no longer viewed complacently, and the growing popularity of blood transfusion is one of the hopeful signs of the times.

Premature separation of the placenta from a normal region of implantation has never been fully explained. However, since 1912 we have come to realize that uteroplacental apoplexy is associated with two lesions, namely, detachment of the placenta and hemorrhage between the muscle cells of the uterus. As both lesions impair the function of contraction, the organ becomes distended. Its wall becomes board-like and mapping out of the fetus becomes impossible—developments which point to a correct diagnosis of placental separation. Because muscular disorganization prohibits effective contraction and because the uterus should be evacuated to stop bleeding, cesarean section may become imperative. At operation a purplish discoloration of the uterus warrants hysterectomy to avoid subsequent hemorrhage, for the damage to the muscle fibers enhances liability to postpartum atony.

Placenta previa is frequently treated nowadays by cesarean section. Procedures recommended in the past—*accouchement forcé*, packing the cervix with gauze, introducing a bag into the uterus, seizing a foot of the fetus and pulling the buttocks down to shut off the placental circulation—have been given up. Elimination of these maneuvers has reduced the death rate from infection and hemorrhage as well.

For adroit means of ascertaining the position of the placenta *in utero* we have *x*-ray films to thank. They permit measurement of the distance between the fetal head and the mother's bladder in the latter months of pregnancy. If the placenta lies between them, placenta previa, the distance in question becomes somewhat longer. The technic consists of distending the bladder preferably with air. Then stereoplates are made with the patient lying on her back and a supplementary single film is taken in the lateral position. From a study of these views, the location of the placenta may be reckoned, provided its attachment occupies the lower uterine segment. A negative result prompts search elsewhere and persistent effort usually yields the information desired.

For the control of *postpartum hemorrhage*, facilities quite unknown two generations ago are now standard equipment of every obstetrical service worthy to exist. Posterior pituitary extract (1909) and the potent principle of ergot (1932)—variously named by manufacturing chemists—are ready for instant use. On trial, too, is the recently described preparation of oxalic acid for hypodermic administration. Saline and glucose solutions (1920) are nearby, and the blood-bank may be drawn upon without delay.

The possibility of serious bleeding has never passed when the patient leaves the

delivery room, nor even a few days later. Indeed, sudden profuse hemorrhage, late postpartum hemorrhage, may occur at any time in the puerperium. Its most common cause, the retention of placental fragments, calls for the exploration of the uterine cavity and the removal of whatever abnormal tissue is found there. The use of the curette for the purpose has been rightly condemned. Ordinarily a finger or blunt forceps will suffice.

In a few cases of submucous myomata and other occasional complications the control of late postpartum hemorrhage demands hysterectomy. Prompt operation, we have learned, will save life. On the other hand, whenever infection of the uterus is the cause of hemorrhage, hysterectomy is futile. In such a case, measures usually described as medical must be relied on; and efficient treatment has been superbly implemented by sulfanilamide.

RADIOLOGIC REVELATIONS

As the discovery of roentgen rays was published in 1895, the life history of their application to medicine and the period of this review of progress in obstetrics are practically the same. At first their usefulness during gestation was limited to such direct service as the determining of fetal presentation, skeletal abnormality and multiple pregnancy. As the years passed, especially since 1921, refinements of technic have steadily broadened the scope of radiology until today it occupies an eminent—perhaps one should say pre-eminent—position among the innovations that have advanced the sound practice of obstetrics. We have no more reliable guide to correct prediction when fetal or pelvic dystocia is to be anticipated. For this dependability films showing better detail in two planes are largely responsible.

The mechanism of fetal adaptation to the birth canal, hitherto poorly understood, stands clearly pictured in serial films executed from start to finish of the expulsive stage of labor. Function has thus become a criterion in grouping pelves, and morphologic concepts have supplemented the etiologic classification. Since we are living in a transition period, a word or two will not be amiss concerning the way in which contemporary obstetricians reach a decision where they anticipate pelvic dystocia.

At routine antepartum examination, the external measurements having been made and the internal configuration of the birth canal explored digitally, the pelvis is nominated normal, flat, generally contracted, rachitic or funnel as the case may be. If some untoward influence upon the course of labor is suspected, radiologic confirmation is sought. The trend of thought then takes a new direction, interpretation of the films proceeding along the lines of the morphologic classification; gynecoid, android, anthropoid, platypelloid.

Flat plates are never trustworthy as an index of disproportion between the fetus and the pelvic canal, because divergence of the rays magnifies objects unequally according to their distance from the film. Correct estimation of essential factors in the mechanism of labor has awaited more perfect development of *x*-ray technic. Discussion of the ingenious features of this technic would carry us far afield. Suffice it to say that many radiologic procedures have been devised for measuring the fetal head *in utero* as well as the dimensions of the space enclosed within the mother's pelvic bones.

As the multiplicity of methods would suggest, roentgenographic pelvimetry has not yet reached maturity. Some of these methods are complicated, requiring several persons in consultation to master their intricacies, by checking mathematic calculations and other requisites. Simpler procedures may perhaps give dimensions a trifle larger than actually exist, particularly those of the pelvic outlet; but they serve practical if not scientific purposes. Present achievements justify faith in the future. Ultimately, there will be forthcoming a method without limitations, workable alike in well staffed university clinics and in the radiologic departments of small hospitals.

Besides portraying the architecture of the pelvis and elucidating the mechanism of labor, radiology has made many other substantial gifts to obstetrics which, as a token of appreciation, may be summarized in tabular form as follows:

1. Locating the placental attachment to the wall of the uterus.
2. Defining the spread of the pelvic joints during pregnancy.
3. Revealing precisely the presentation and position of the fetus.
4. Giving reliable evidence of multiple pregnancy.
5. Indicating the amount of amniotic fluid; the presence of hydramnios.
6. Depicting skeletal deformities of the fetus and fetus papyraceous.
7. Differentiating pregnancy from pelvic neoplasms.
8. Assisting the diagnosis of hydatidiform mole and missed abortion.
9. Demonstrating collapse of the skull after death of the fetus.
10. Diagnosing fractures in the new born, pulmonary atelectasis, pneumothorax, circulatory abnormalities, gastrointestinal defects and enlargement of the thymus gland.

THE DÉBUT OF THE FUNNEL PELVIS

Prior to 1909, in measurement of the pelvis the dimensions of the inlet monopolized the obstetrician's attention. He assumed that once the fetal head entered the birth canal, certainly when it reached the level of the ischial spines, no extraordinary bony resistance would be encountered unless the patient had a kyphotic spine or some other prominent deformity of the skeleton. This doctrine persisted despite the fact that every now and then there was prolonged delay after the head rested on the pelvic floor, and eventually its expulsion caused a complete tear. For these complications a rigid perineum was held responsible, but we now know the configuration of the bony outlet explains both phenomena.

Whenever the dimensions of the superior strait are normal and those of the inferior strait are less than normal, the diagnosis is funnel pelvis. Associated with it as a rule will be found an assimilation sacrum containing six vertebrae, the most frequent of pelvic abnormalities. The *x*-ray, of course, gives clear proof of its existence. It reveals also the frequent presence of a high assimilation sacrum in the anthropoid type of pelvis. From a developmental standpoint, therefore, this anomaly emphasizes kinship between man and the ape.

Routine measurements of the pelvic outlet begin with the transverse diameter, the distance between the ischial tuberosities. But that observation alone is not sufficient. Although the transverse diameter be narrow, normal birth may still be possible, provided the space behind the tubera will accommodate the fetal head. This possibility is appraised by measurement of the posterior sagittal diameter—the distance from the tip of the sacrum to an imaginary line joining the ischial tuberosities.

If proximity of the tuberosities prohibits near approach of the fetal head to the symphysis pubis, the act of expulsion throws great strain upon the perineum. Thus are occasioned the deep lacerations which extend at times through the sphincter ani into the rectum itself. Restricted dimensions of the pelvic outlet may require cesarean section. The size of the fetus, obviously, will be the deciding factor, the decision being reached to best advantage before the onset of labor.

LOW CERVICAL CESAREAN

Now and then a doctor is startled by the calm announcement of a prospective mother consulting him for the first time that she proposes to have "a cesarean birth," as if such treatment were a matter of choice and not compulsion. Sometimes such an attitude is due to unpleasant memories of a previous labor; sometimes a primipara, alarmed by the idle talk of acquaintances, is intent on escape from what she fears will be severe punishment, even with a normal delivery. At all events such incidents speak eloquently of the good

name cesarean now enjoys, in strong contrast with the repute in which it was formerly held. In the history of cesarean births, the modern era dates from 1882 and the practice of suturing the uterine wound at first with silk and later with catgut. Although there were smooth recoveries here and there, doctors continued to hesitate before resorting to the operation and at times hesitated too long.

Alert obstetricians sensed an intimate relationship between the length of labor preceding operation and the character of the convalescence that followed it. Their suspicion was proved correct in 1907 by the analysis of extensive material from the standpoint of "the patient's constitutional equipment when the operation was performed." There was never a clearer verdict. The risk of a cesarean section undertaken at the onset of labor resembled that of an interval appendectomy, whereas death ensued in half the cases when a cesarean operation was postponed until the woman had become exhausted.

Those who took that truth to heart had much less to worry over when the patient left the operating table. Infections became less frequent and the death rate diminished. Yet the need for further improvement was obvious and numerous modifications in technic were suggested. Some of these had short life; others grew in popularity. Foremost among the latter was the low cervical operation, which has reduced post cesarean mortality from 5 per cent to 2 per cent or even less.

Advocated sporadically in 1906 and pictured in a German textbook in 1912, "low cervical" attracted attention in America in 1919. Its merits have been proclaimed with increasing insistence ever since. The peculiarities of the technic, briefly described, consist in severing the vesical reflection of the peritoneum from one round ligament to the other, lifting the bladder from its uterine attachment, and incising the lower segment of the uterus, either vertically or transversely. Which direction the incision should take is a matter of dispute. The vertical incision requires special care to protect the bladder; the transverse endangers large blood vessels. The latter technic may be the choice of experience; the former must be recommended during a period of apprenticeship.

What is gained by the employment of a low cervical cesarean operation? (1) The uterus is opened in an area well calculated to withstand trauma. (2) At the end of the operation the uterine wound has been covered completely with peritoneum. (3) Vaginal drainage is procured with the least risk of contaminating adjacent structures. (4) A preliminary test of labor—not unduly prolonged—does not prejudice the outcome, though the membranes are ruptured. (5) Convalescence proceeds more smoothly than after the classical operation.

Complete exclusion of the peritoneal cavity from the scene of operation—extraperitoneal cesarean—is commendable only in the presence of frank infection. Many of the extraperitoneal procedures invented have been given up after fair trial, for they jeopardized large blood vessels as well as the bladder and ureters. Whether a technic devised two years ago will, in the hands of random operators, avert the complications fatal to its predecessors, it is yet too soon to say.

Local and Spinal Anesthesia. With respect to cesarean section, objections raised against the use of inhalation anesthesia have been confirmed. Chloroform provokes degenerative lesions in the liver and the heart. Prolonged administration of nitrous oxide or ether has, among other unwelcome effects, that of deeply narcotising the infant. While none of these ill effects are produced by ethylene or cyclopropane, enthusiasm for these gases has been modified by explosions which occurred despite intelligent precautions. The need for new methods has been obvious. Although still on trial, nerve blocking with the less toxic derivatives of cocaine has received stronger and stronger endorsement since 1914. Opinions as to the relative merits of spinal and local anesthesia still

differ; but on one point there is complete agreement. Neither procedure harms the infant. It is fortunate that we have a choice between two good methods.

MINOR OBSTETRICAL OPERATIONS

On the ground that they do much good to large numbers of patients, minor surgical procedures deserve great praise. In the long view, some of them promote health more clearly though less dramatically than major operations.

Episiotomy (1918) in primiparae insures the most perfect perineal restoration possible. A median incision gives the better plastic result; a lateral provides more protection for the sphincter. Good judgment, arrived at with full knowledge of the pelvic outlet architecture, dictates the site of the incision.

Through-and-through silk worm sutures, happily, went into the discard three decades ago. The technic of perineal repair now in vogue, using catgut to reunite vaginal mucosa, muscle and skin in sequence, adds materially to the immediate strength of the pelvic floor and prevents a mechanism responsible for invalidism later on.

Cervical lacerations, formerly disregarded unless they caused postpartum hemorrhage, now receive routine attention in well conducted clinics. The intermediate repair—fourth to ninth day—has grown in favor since 1900, though most obstetricians prefer to suture all kinds of lacerations at the conclusion of labor. The time for doing this operation is less important than its ultimate significance. Everyone shares the conviction that a postpartum cervix should be left as it was when pregnancy began. The attainment of that ideal will reduce among women who have borne children the incidence of gynecologic disease: chronic leucorrhea, erosions, polyps and cervical carcinoma.

ELECTIVE INDUCTION OF LABOR: PRO AND CON

Attempts to bring on labor without the introduction of a bag or bougie into the uterus have been more successful of late than heretofore. After term is reached trial-induction with castor oil and quinine succeeds in approximately 25 per cent of the cases. When that measure is supplemented by the administration of a very small amount of posterior pituitary extract, the frequency of success approaches 75 per cent. But the efficacy of these procedures reaches 98 per cent after "the waters have broken," provided no mechanical obstruction hinders progress.

Deliberately rupturing the membranes to bring on labor violates a traditional obstetrical canon, and until 1928 it was an unforgivable sin. Our elders condemned such interference because they assumed that the bag of waters dilated the cervix in the normal course of events. But the theory of the hydrostatic wedge has been so completely disproved that it is merely necessary to record its extinction. Actually, dilatation is brought about by contractions of the uterus which rearrange its muscular layers, thinning out the lower segment and pulling the rim of the cervix upward toward the fundus.

During pregnancy the amniotic sac keeps its contents sterile. A broken sac ceases to protect against infection. Nevertheless, the deplorable consequences of premature rupture are confined to cases in which labor was prolonged and vaginal examinations made carelessly or at short intervals. The latter risk is avoided by replacing vaginal with rectal examinations, their value having been recognized since the beginning of the present century.

A protracted labor is due, not to premature rupture of the membranes, but to the presence of pelvic contraction, fetal malposition or some other accredited cause of dystocia. It is incumbent on the doctor to exclude the possibility of such contingencies before he sets out upon induction by any method. Artificial rupture of the membranes, in particular, requires care and foresight and should be practised only by a well qualified obstetrician who has made use of all the prognostic measures at our

disposal, including if necessary *x*-ray films.

It is clear, in view of the hazards which sometimes halt the progress of labor, that rupture of the membranes can never be employed as a routine procedure. The interval between the time when they are ruptured artificially and the conclusion of labor ought not to exceed twelve hours, a period which ordinarily it is feasible to predict. On that basis only should cases be selected for induction. Proponents of the method find that the interval averages six to eight hours in primiparae, four hours in multiparae. These are the estimates of observers who have adhered strictly to the following dependable rules for guidance: (1) The subjects were approximately at term. (2) The presenting part was well engaged. (3) The cervix had opened sufficiently to admit a finger along with a small instrument suitable for rupturing the membranes. (4) Castor oil, and three to five grains of quinine, or both have previously been administered. (5) Posterior pituitary extract has been applied intranasally, or administered hypodermically in a *one minim dose*, if uterine contractions failed to begin within two hours after the membranes were ruptured.

Favorable conditions for induction prevail more frequently than used to be expected before weekly vaginal examinations during the last month of pregnancy became customary. Such favorable conditions appear earlier in multiparae than in primiparae, but are noted in a majority of both classes. When they are present, elective induction serves the convenience of both patient and obstetrician, for it shortens labor and minimizes damage to the cervix, while it does not increase morbidity, either maternal or fetal.

It should be remembered, however, that calamities following induction have been reported. In some cases, as for example, with cardiac decompensation, the issue would have been fatal no matter what the mode of delivery. In others, the subjects of elective induction were improperly chosen, without adequate regard for the guiding rules already emphasized. These rules must never be evaded. If after proper care has been taken, complications arise—as they may in any long series of deliveries, whether the onset of labor is spontaneous or induced—the well trained obstetrician meets the situation according to habit, for the contingencies of elective induction differ in no way from those long familiar to the profession.

FIRMER CONTROL OF INFECTION

From first place in our maternal mortality rates, puerperal infection has shifted to third place, thanks to innovations in both prevention and cure. Outstanding are the contributions of the laboratory: precise identification of pathogenic bacteria and synthesis of chemotherapeutic agents. But no less substantial are the strict precautions now taken to avoid contamination of the birth canal. Every day we employ these tactics—details of preparing the patient, proper arrangement of the dressings, disinfection of the hands of nurse and doctor—as if we had practised them always, whereas many of them were the novelties of fifty years ago or had not been devised at all.

Early attempts to disinfect the hands were tedious, cumbersome, sometimes painful, never really satisfactory. The most elaborate toilet required a quarter of an hour: ten minutes of scrubbing with a stiff brush and soap and water, immersion of the hands in saturated solutions first of potassium permanganate, then of oxalic acid, and a final soaking for three minutes in a strong solution of corrosive sublimate. The ritual astonished young graduates assigned by the medical school to obstetrical duty and astonished even more the patients entrusted to their care who had been accustomed to cramped quarters and easy going sanitation. A Negro woman whose five or six children had been born under the ministrations of a midwife of her own race decided on the next occasion to have the hospital doctor for home confinement.

While hygienic preparations were in progress she observed the nurse with puzzled interest. Later, as she watched doctor and student cleansing their hands one after the other, she began to be alarmed. Finally, she blurted out, "Chillun, if I'd know'd you all hands was that dirty, I never would a had you!"

All this changed for the better when rubber gloves were invented. A surgeon devised them because his operating room nurse—whom he later married—suffered continually from a bichloride rash. The original pattern, made of heavy rubber with broad cemented seams, was ill-suited to obstetrical use; but before long it was superseded by a thin seamless design still employed. With hands so covered, the doctor found his sense of touch was not so dulled as to interfere with his recognition of the state of the cervix, the part of the fetus which presented or the location of the cranial sutures, or as to prohibit accurate application of the obstetrical forceps and manual removal of the placenta.

The protection against infection afforded by this simple device is self-evident. It is a contribution no less to obstetrics than to surgery, and merits a high place on the honor roll of notable innovations of our times.

Bacteriology. To the list of organisms that cause childbed fever—a list begun about the middle of the last century with the isolation of streptococcus and staphylococcus from the infected uterus—there have been added the gonococcus (1893), colon bacillus (1893), gas bacillus (1896), typhoid bacillus (1898), and many other bacteria. Extensive studies of the pyogenic cocci have probed deep into their traits of character. At least thirty-six strains of streptococci have been isolated from the puerperal uterus: aerobic, anerobic, hemolytic, nonhemolytic; a complete classification would take us far afield. Yet the theme has important practical implications. The various strains differ in virulence and in resistance to chemotherapeutic agents; and these differences may explain what would otherwise appear as contradictory clinical results of sulfanilamide therapy.

Sulfanilamide. Through the use of this drug maternal mortality caused by streptococcic infection has been reduced from 23 to 5 per cent—a superlative achievement. Although some of its pharmacologic aspects have not been clarified, it is safe to say that sulfanilamide acts like drugs that destroy intestinal parasites and like organic arsenicals that conquer protozoan invasion of the blood stream. It was the first bacterial chemotherapeutic agent to enter a field rapidly widening in scope.

Although sulfanilamide was synthesized in 1908, its curative effects upon human disease were not announced until 1935. Why the long delay? An enormous amount of experimental work was necessary. On account of its chemical conformation, the properties of the drug are specific. Although it has two thousand near relatives, only a few of them are valuable in therapeutics. Its twin sisters orthanilamide and metanilamide are inert as drugs. To single out the useful member of so large a chemical family took time. Moreover, sulfanilamide has a lethal action only upon certain bacteria, conspicuously upon the beta (hemolytic) streptococci. With all these variables in the problem, time-consuming animal experimentation alone could catalogue the effects of hundreds of chemicals upon two score strains of streptococci.

By a fortunate coincidence, sulfanilamide acts most powerfully upon the type of streptococcus that predominates in childbed fever. Alpha (viridans) and anerobic streptococci, less frequent offenders, resist the drug very much more successfully. The same holds true for staphylococci, pneumococci and gas bacilli. Sulfapyridine qualifies, but not perfectly, as a specific for the pneumococcus; sulfathiazole for staphylococcus, and to sulfanilamide the gonococcus is extremely susceptible.

How do chemotherapeutic drugs retard the growth of bacteria? Scientific curiosity demands more than the coining of terms like *bactericidal* and *bacteriostatic;* it seeks to

learn how the effects are obtained. The action of the drugs remains thus far hypothetical. One theory emphasizes the inhibition of bacterial reproduction, another the impairment of food assimilation. The latter more popular explanation may actually account for the diminished reproduction of the invading organisms and their death.

Adequate dosage of sulfanilamide is regulated by estimating its concentration in the blood of the recipient—a test unique in all therapeutics and most useful. The drug is toxic and its administration is modified or discontinued the moment its concentration in the blood has reached a certain point.

Sulfanilamide therapy is no panacea. As has been said, a great many bacteria are insensitive to the drug. It cures approximately one-half the cases of puerperal infection immediately and spectacularly. In other cases, which respond slowly, it is difficult to decide how much credit should be given the patient's natural powers of recuperation. Somewhat less than one-fourth of the patients who are profoundly infected die in spite of ample medication.

As to the wisdom of using sulfanilamide during pregnancy, opinions differ. It passes through the placenta and reaches the fetus, and harmful results have been observed in experimental animals. Repeated massive doses given pregnant rats stunted intrauterine growth, caused still-births and increased postnatal mortality. It is obvious that the administration of sulfanilamide to pregnant women with pyelitis or with gonorrhea should proceed cautiously.

Autoinfection. Are bacteria capable of causing puerperal infection to be found in the vagina of healthy pregnant women? This question, argued back and forth for years, has never been quite settled. Uniform methods of investigation, however, have tended to reconcile the conflicting opinions; and the dominant view at present is that streptococci which have been cultured from the vagina during pregnancy are not virulent to the woman who harbors them. In fact, self-infection is looked upon as highly improbable if not impossible. The agents of childbed fever enter the birth canal from without.

Yet extragenital infections do occur occasionally at the time of childbirth. Recently an epidemic of puerperal peritonitis in a well conducted maternity hospital was traced to primary infection of the respiratory tract. The clues, sifted intelligently, prompted effective prophylaxis. Regulations which banished from the delivery room doctors and nurses whose nasal secretion contained streptococci removed the risk of contagion. The epidemic was promptly wiped out and did not recur.

BETTER CARE OF THE NEWBORN

Although in their efforts to promote the birth of a healthy child, obstetricians succeed much more uniformly than they did half a century ago, the steady decline in infant mortality is to be credited largely to increased efficiency on the part of pediatricians. The mortality rate in the United States in 1939 for infants under one year of age was 48.2 deaths per thousand live births—an all time low. An even more favorable figure, 40 deaths per thousand in New York and Chicago, surpassed the splendid record of the Scandinavian countries prior to 1940 and the European conflict.

These excellent results in America are attributable largely to the systematic supervision now accorded young infants. Though the principles involved cannot be elaborated here, a few outstanding achievements should be mentioned. Surgical treatment of pyloric stenosis has reduced the mortality of this complication from 70 to 2 per cent. Prompt operations on hare-lip and club-foot have become commonplace. Hemorrhagic disease of the newborn has been treated successfully by blood transfusion, and more recently by vitamin K. Pyelitis has been recognized in very young infants and the technic of ureteral catheterization in these difficult subjects has been mastered by urologists. Moreover, the general adoption of many valuable innovations

in infant feeding and in nursery sanitation attests both the skill and ingenuity of the pediatrician as well as his grasp of social problems.

THE VOICE OF STATISTICS

Under the caption, "a medical and social puzzle," an editorial writer in a prominent metropolitan newspaper recently acclaimed the reduction in the rates of maternal mortality and speculated as to its causes. The facts are beyond dispute, for the Census Bureau Report of February 10, 1940, shows that deaths in childbirth decreased 11 per cent in the single year 1938 and declined 30 per cent during a period of ten years. With the thought of socialism as applied to medicine, the editorial writer turned for an explanation to more adequate public health administration with extensive federal and state aid, to subsidized postgraduate instruction, to familiarity of the public with birth control and to a higher standard of living. He was convinced, however, that these influences were not sufficient to account for all the improvement; and for the rest of the solution he left his readers to ponder.

Had the lay writer been able also to look at the problem from within the profession he might have found it less baffling. Anyone who contemplates impartially the handicaps suffered by our elders, who contrasts Victorian midwifery with obstetrical practice stimulated by laboratory and clinical research, will recognize the basic reason for our progress. He will give due credit to more thorough knowledge, applied with increasing competence, and will recognize among obstetricians a steady gain in personal efficiency.

Let us look at the record. In 1938, the last year for which complete data have been published, there were 9,953 deaths attributed to "puerperal causes." This yields a maternal mortality rate of 43.5 per 10,000 live births, the lowest record in the United States. Of these deaths, nearly one-fourth followed ectopic pregnancies and abortions savoring of illegality; and for these bad obstetrics cannot be blamed. Maternal deaths at or near term were chargeable as follows: to hemorrhage and other accidents of pregnancy, 27 per cent; to toxemias 25 per cent; to infections 24 per cent. Some of these tragedies, presumably, could have been avoided, and the outlook for further diminution of the death rate from such causes grows constantly brighter.

More intimate analysis of the figures for 1938 reveals the fact that, in comparison with the previous year, deaths from infection decreased 12 per cent, from toxemias 11 per cent and from hemorrhage only 7 per cent. Explanation for the favorable trend and hope for its continuance must take into account the quality of supervision now given women during pregnancy and the services available at the time of delivery.

Less obvious to laymen and to semi-professionals than to those who participate in the work are the signs of increasing competence as one generation of obstetricians follows another. Our fathers received diplomas after a two-year course in medicine and opened office at once. The better grounded graduate of today expects his training as interne to fit him to practise independently. Moreover, his apprenticeship in a well managed clinic equips him to profit by the reports in journals, monographs and books and to interpret his personal experience. It qualifies him, in fact, to continue self-education after formal instruction has ended.

The vital statistics gathered by our Census Bureau speak with authority. They tell a story in which we all can take pride, a story of lives saved and health safeguarded, of happiness in homes that would once have been inevitably desolate, of greater human welfare where our need has been most compelling. It is an achievement in which state and federal agencies, research institutions, university clinics and individuals in private practice all have their share. A brilliant chapter in the story, as I have tried to show, is the record of new concepts and new practices, based on the findings of clinic and laboratory. Witness a bead-roll

of praiseworthy contributions to the progress of obstetrics during the period we have passed in review:

1. The hormonal urine test, most accurate of all biologic tests, which affords a very early diagnosis of pregnancy.

2. The role of progesterone in promoting secure implantation of the ovum; of estrogen in sensitizing the uterine muscle preliminary to labor; of the posterior pituitary hormone, in serving as a powerful oxytocic.

3. The recognition of the chromosomes in the nucleus of the sex cells as the physical basis of heredity; and of those of the spermatozoan as determining whether the embryo shall be male or female.

4. The cause and effect relationship between unfitness of the embryo and spontaneous abortion.

5. Identification of fetal tissue as the source of both hydatidiform mole and chorionepithelioma.

6. Recourse to periodic consultations with prospective mothers to consider the significance of ailments, to watch the gain in weight, to regulate the diet and in general to emphasize a healthful way of living.

7. Systematic blood pressure estimates to detect pre-eclamptic toxemia and allied states in their incipiency.

8. Serodiagnosis of syphilis; specific treatment with organic arsenicals during pregnancy to protect mother and offspring alike.

9. Definition of uteroplacental apoplexy as the most insiduous type of premature placental separation.

10. Application of radiology to the diagnosis of placenta previa.

11. Contributions to the treatment of postpartum hemorrhage: the active principle of ergot, intravenous glucose, blood transfusion, the blood-bank.

12. Radiologic demonstration of multiple pregnancy, of fetal position, of size and deformity.

13. *X*-ray pelvimetry, featuring functional capacity as a criterion of pelvic classification.

14. Demonstration of outlet contraction as a cause of dystocia.

15. Persistent search for perfect analgesia during the first stage of labor.

16. Local and spinal anesthesia for the performance of pelvic surgery.

17. Refinements in the technic of cesarean section; the low cervical operation.

18. Induction of labor in selected cases by rupture of the membranes.

19. Better execution of perineal and cervical repairs.

20. Isolation of many varieties of bacteria that cause puerperal infection; classification of streptococci.

21. Proof of extra genital infection at the time of labor.

22. The wearing of rubber gloves to prevent contamination of the birth canal.

23. The use of chemotherapeutic agents to combat puerperal infection.

NOTES ON FIFTY YEARS OF PROGRESS IN GYNECOLOGY

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HISTORY has been written in a variety of ways, as a chronologic list of discoveries or events which mark the milestones, in terms of the personalities whose lives typify their day, or as an analysis of trends of thought or organization which characterize a particular epoch. All of these aspects need to be considered even in the fraction of history represented by the record of half a century of progress in a single division of medicine.

In 1891, gynecology was already a well defined specialty, perhaps even more distinct and circumscribed than it is at present. It had been founded upon a series of brilliant technical achievements in the surgery of the pelvis. These accomplishments in turn had been made possible by the recent discoveries in anesthesia, bacteriology and microscopic pathology.

It is interesting to consider for a moment this scientific background against which the gynecology of 1890 was placed. Anesthesia had been in use for nearly fifty years since the 1840's when Long and Morton had experimented with ether, Wells with nitrous oxide and Simpson, in England, with chloroform. "Cellular-Pathologie" had appeared in 1858, but in the early nineties Virchow was still active in science and a member of the Reichstag in Berlin. Pasteur and Koch were alive, although their greatest work had been done some years before. Lister's development of antisepsis, first reported in 1867, was little over twenty years old when this period started.

Gynecologic surgery had in fact made a small but heroic beginning before these discoveries which now seem to us the prerequisites to all surgery. McDowell's "ovariotomy" in 1809 has been justly regarded as the starting point of pelvic abdominal surgery. Sims' work on the repair of vesicovaginal fistula, published in 1852, had opened the field of vaginal plastic operations and was already a classic by the beginning of the final decade of the century. Most of the operations now employed had their prototypes in 1891, many crudely done, some with an exorbitant mortality. Nevertheless they were all known in principle: plastic operations on the perineum, anterior vaginal wall and cervix, hysterectomy and myomectomy, salpingectomy for pus tube and ectopic pregnancy. The future of pelvic surgery was not to lie chiefly in the discovery of new operations, but in the refinement of already understood technics; and the extraordinary expansion of gynecology as a whole was to take place on the basis of new and undreamed of discoveries in the fields of physics and physiology.

In 1891, the first generation of post-Listerian gynecologists was still at work. Spencer Wells, one of the earliest of the "ovariotomists," was an old man but had several years yet to live. Lawson Tait in Edinburgh was at the height of his powers, but unlike Wells was to come to an early death. In Germany, Hegar, Olshausen, August Martin and other pioneers were still active.

In America a long list of men with remembered names occupied positions whose very titles indicate that the form of organization of university departments in the diseases of women was far from settled. Goodell was professor of gynecology at the University of Pennsylvania and Barton Cooke Hirst already professor of obstetrics. Howard Kelly at this time held the chair of both gynecology and obstetrics at Johns Hopkins. Thomas Emmet was surgeon to the Woman's Hospital and T. Gaillard Thomas, professor emeritus of the diseases

of women and children at the College of Physicians and Surgeons. Skene was professor of the medical and surgical diseases of women at the Long Island College Hospital. William Lusk, exhibiting apparently the ultimate in versatility, was professor of obstetrics, of diseases of women and children and of clinical midwifery at Bellevue Hospital Medical College and was in addition physician to Bellevue Hospital.

At this time New York and Philadelphia dominated the gynecologic scene in America. Johns Hopkins was approaching its great days and Boston appears to have been contributing little that was new to pelvic surgery. Many now great university services had not yet been conceived. Full time hospital and medical school staffs seemed as far off as other aspects of socialized medicine.

When one peruses the scientific papers of this time, one is impressed with the fact that the nineties were a period of hesitation. The anatomic problems of surgical technic has been grasped but the new directions for advance were not clear. In September of 1891, the American Gynecologic Society met in Washington and listened to a variety of undistinguished papers on technical procedures, such as high amputation for cancer of the cervix, on galvanism in the treatment of fibroids, and on the avoidance of operation for ectopic pregnancy by the injection of morphine into the fetal sac. The articles submitted to the "American Journal of Obstetrics and Diseases of Women and Children" in that year indicate that the profession at that time was preoccupied with three subjects, uterine fibroids, pyosalpinx and ectopic pregnancy. A few papers on the physiology of menstruation are now unbelievably archaic in conception. The dearth of articles on gynecologic cancer indicates an attitude of hopelessness toward this disease. A book review on the advice a mother should give her daughter suggests that the gynecologist of the nineties was already puzzled over this problem and that the situation then was little more satisfactory than it is at present.

The German literature of the time foreshadows the leadership that the universities of that country were soon to exercise in bringing the laboratory closer to the clinic. The articles in the Archiv für Gynäkologie for 1891 are longer and better written than most of those in contemporary American journals and show the ponderous thoroughness which was to be the source of admiration and annoyance to the foreign reader. One finds Doederlein and Bumm at work on bacteriologic problems, Pfannenstiel studying the origin of the ciliated epithelial cysts of the ovary. One finds also the beginning of statistical attempts to evaluate the success of treatment of uterine cancer. Of physiology in a modern sense, of a rational therapy of functional disorders there is of course nothing.

The early 1890's were thus characterised by a breathing spell before new adventures. Men had the opportunity to look around and to measure the ground that had been won. The successes of the first quarter century of modern surgery were dazzling and the result was a veritable burst of new textbooks. Within the course of a few years there appeared works on gynecology by Goodell (1887), the Byfords of Chicago (1888), Lawson Tait (1889), Hart and Barbour of Edinburgh (1890), a translation of a series of lectures by August Martin of Berlin (1890), a large treatise by T. Gaillard Thomas and Paul Mundé of New York, and an American translation of Pozzi's fine two-volume work in 1892. Collaborative works were also making their first appearance, as for example, "A System of Gynecology by American Authors" (1887), "An American Text Book of Gynecology" (1894) and finally the first edition of the greatest of gynecologic works, Veit's "Handbuch der Gynäkologie" in 1897.

It is easy to feel a sense of superiority in turning the pages of these works of the earlier days of gynecology. Even their appearance seems old fashioned with their quaint illustrations and fantastic reproduc-

tions of histologic structure. Yet the style is individualistic, and hence often more readable than many of the more formalized texts of the present day. Certain types of cases were still rare enough to justify their recounting in terms of personal anecdote, and new clinical entities must have seemed to lurk about every corner. Opinions were freely expressed, unblushingly, without benefit of statistics or laboratory experiment.

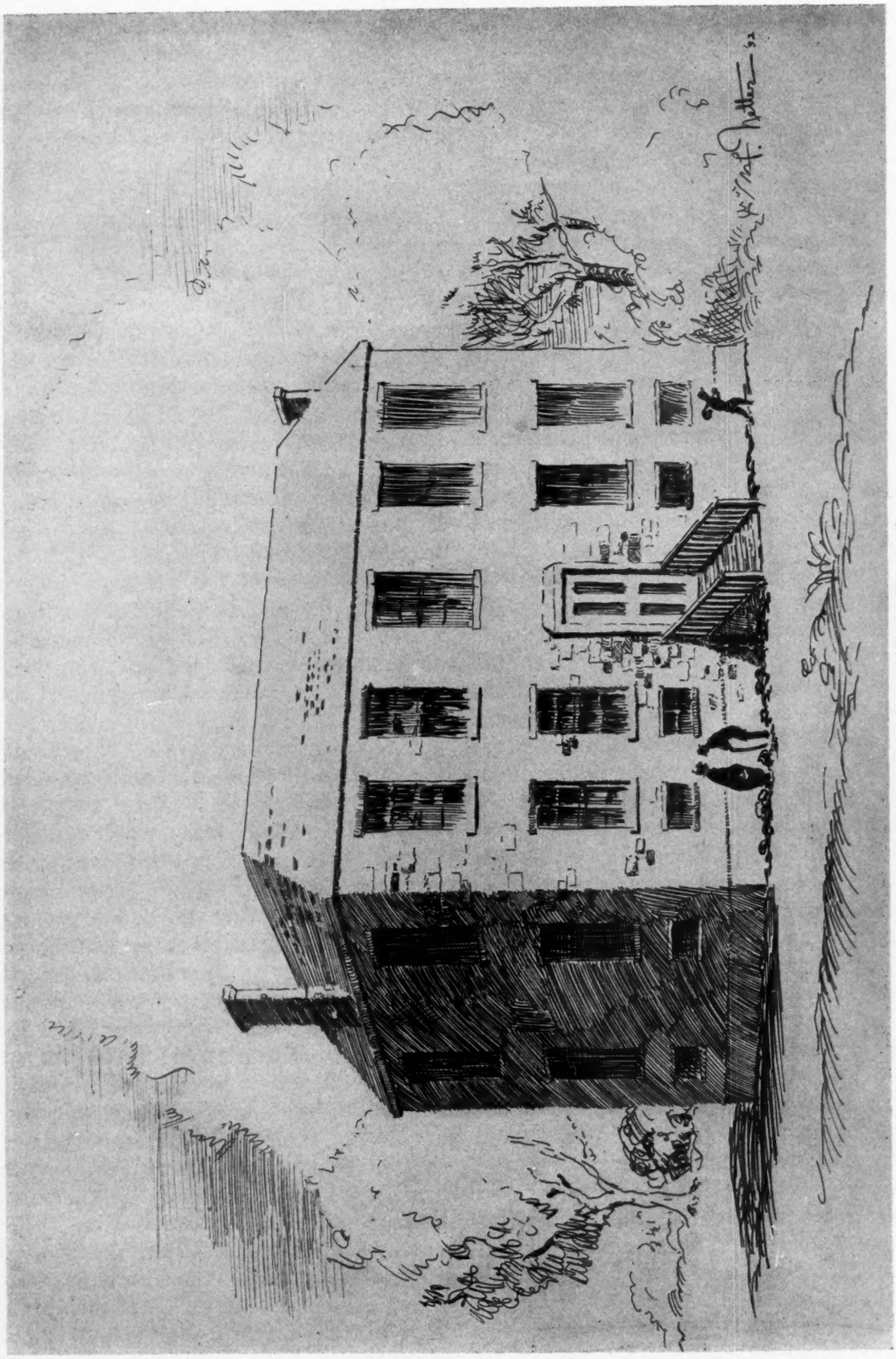
Yet about many common gynecologic diseases there was evidently considerable haziness. Ectopic pregnancy may have been well understood by Tait, but other writers still believed that pelvic hematocele was due to a variety of somewhat mysterious causes. The Byfords devote a section to this disease which they call misplaced menstruation or "metatithimenia." Hart and Barbour were of the opinion that pelvic hematocele could follow violent exercise or coitus during menstruation and that the patient was predisposed to the disorder by various conditions of the subperitoneal veins, purpura, scurvy and hemophilia. Salpingitis undoubtedly often passed under the name of perimetritis and there was considerable doubt, an uncertainty which perhaps still exists, in regard to the relative frequency of the gonococcus as the cause of that disease.

Endometritis was a term applied to a variety of complaints affecting the uterus. Hart and Barbour refer to several supposed varieties, fungous, papillary, senile and exfoliative. Undoubtedly the group included the modern cystic hyperplasias and perhaps several unexplained types of endometrial disorder. The concept of inflammation was a traditional one, tried and dependable; that of a chemically induced hyperplasia was still an hypothesis and unavailable for daily use.

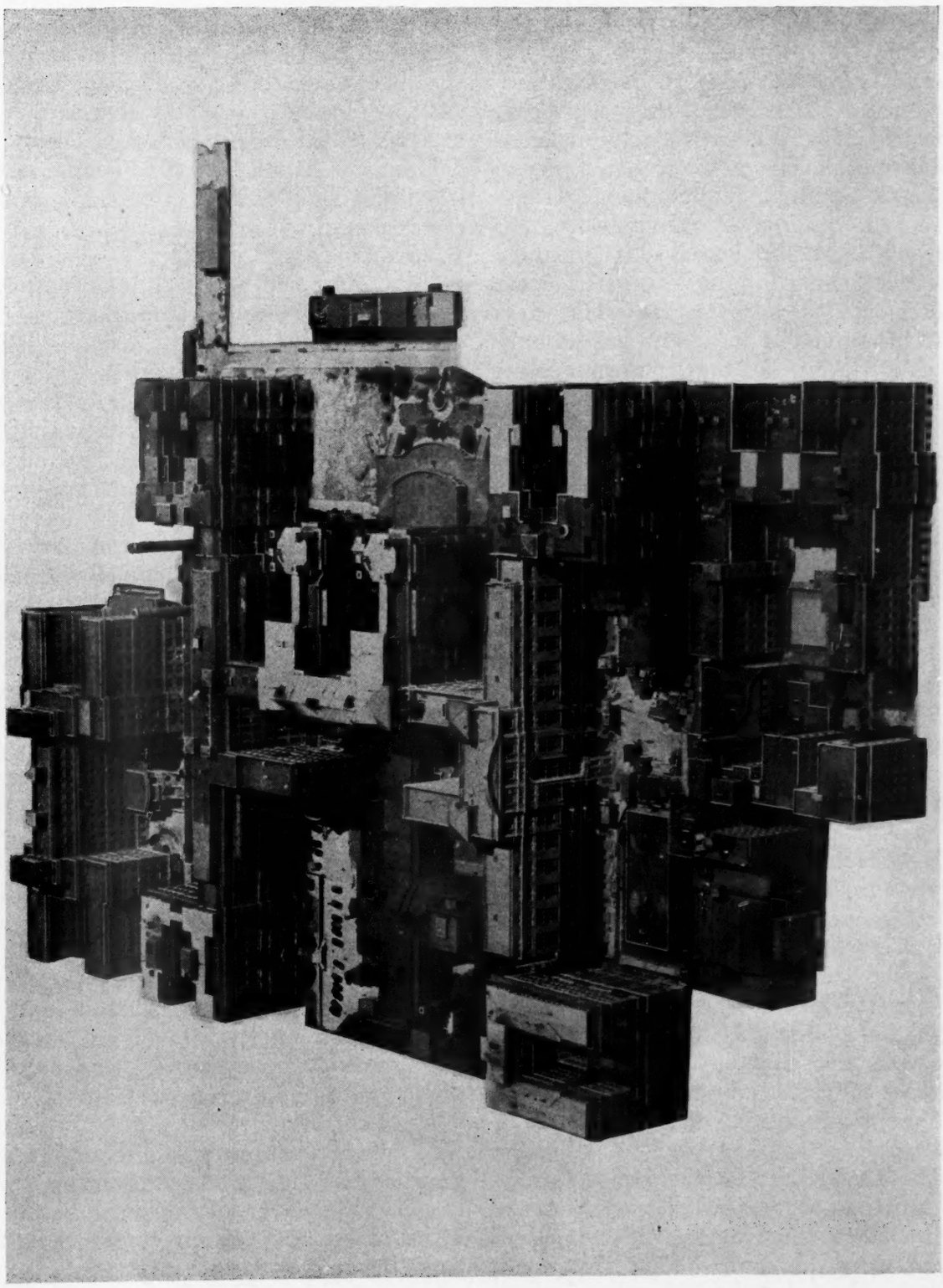
Some clinical conditions, scarcely recognizable by the present day reader, are described so universally by the writers of the day that one wonders whether the moderns may not, in their utter dependence on objectively measurable disorders, be overlooking some of the subtleties of the older practice. The condition that strikes the reader most forcibly is one somewhat vaguely entitled, "chronic metritis" or "chronic parametritis" and "areolar hyperplasia of the uterus." The pathology of the disease was never directly stated, although the more careful writers doubted its inflammatory character. There is no uncertainty, however, about the clinical description. These patients suffered from a cervical catarrh, from backache, bearing down pains, bladder irritability and a variety of reflex symptoms, including, according to Goodell, cold hands and feet, headache, neurasthenia, hysteria and a *facies uterina*. Furthermore the disease was due to improper care in the puerperium, to immoderate sexual activity or to exposure to cold during menstruation.

In other respects, too, the gynecologist of the nineties took a view of his patient which went above the pelvis. Skene devoted four chapters to nervous conditions in relation to gynecology, a point with which most of the men of the time were concerned. True, many ovaries were doubtless sacrificed in the procedure often called Battey's operation for the cure of various complaints such as "hystero-epilepsy, convulsions and threatened insanity," but this point of view kept the specialty from becoming too mechanical and balanced the intense interest in the multitudinous surgical instruments that were being devised. Thomas and Mundé strike a modern note when in a somewhat reckless chapter on "The Etiology of the Diseases Peculiar to Women" they include the prevention of conception and induction of abortion. Beside the effect on the individual's welfare, they believed that birth control was already reducing the number of children in many successful families and that some day this might be a serious threat to the American nation.

With even this glimpse of the gynecologic horizons as they existed before the turn of the century, the extent of the changes that have occurred is inescapable. The pathologic methods of Virchow and



The First Bellevue Hospital—1736



Group of Buildings Comprising Bellevue Hospital Today

his successors have been further applied to the study of all gynecologic lesions until today it seems that no morphologic entities can remain undiscovered. Physiology with biologic chemistry has lately replaced simple morphology as the technic for most advanced research. Radium and radiation have been discovered and applied to the cure of a variety of gynecologic complaints. Above all perhaps the society, in which the gynecologist is working, has changed so that the surgeon has become less an individual performer and much more a member of an organization, whether it be a university, a hospital or a specialty with relatively standardized requirements. A few of the more fundamental lines of progress can alone be briefly traced.

GYNECOLOGIC PATHOLOGY

Although pathology itself was far advanced, the gynecologist of the early nineties was too busy perfecting technic and reducing surgical mortality to indulge himself often in microscopic studies. The change which was to make pathology a part of every medical school course in gynecology and a prerequisite for examinations for certification of qualified specialists was to come gradually. In Germany the interest in this subject was already established in the nineties, and the advances in the field were soon to be almost entirely in the hands of clinical gynecologists. Among the first in America to follow this trend were Henry C. Coe, working at the Woman's Hospital in New York, and Thomas S. Cullen, who made notable contributions on adenomyoma and cancer of the uterus.

The pathologist of the early nineties possessed a good general conception of the commoner uterine tumors and of most of the pelvic inflammatory lesions. Experience had not yet accumulated to allow real accuracy in microscopic diagnosis, and mistakes in the separation of benign from malignant growths were frequently made. Confusion in the classification of ovarian tumors, especially in the solid varieties, was general. Finally, one of the prerequisites of present day gynecologic pathology, the knowledge of the normal cyclical changes in the ovary and endometrium, was totally lacking. Microscopic sections, showing swollen premenstrual glands, were often diagnosed as glandular endometritis and regarded as a pathologic lesion.

Pfannenstiel's classification of ovarian tumors published in 1898 remained the most generally accepted until little over twenty years ago. The defects in this classification, involving principally the solid tumors, were largely eliminated by the studies of Robert Meyer, beginning in 1915, with a description of the granulosa cell tumors and continuing with later work on the arrhenoblastoma and disgerminoma. A development of perhaps even greater importance was the demonstration of the frequency of endometriosis which received special impetus from the paper of Sampson in 1921 and was continued with work by Meyer, Lauche and many American gynecologists.

Beside somewhat better recognition of general tumor types, much effort in the early twentieth century was directed toward the study of degrees of malignancy. The inception of this work may be traced to nongynecologic sources and the work of David Hansemann, but the cancers of the cervix supplied particularly valuable material for such investigations. Here the earliest report was probably that of Schottländer and Kermauner of Vienna, who graded cervical cancer into mature, moderately mature and immature forms. The possibility of demonstrating a relationship between prognosis and the histologic grade of malignancy was perhaps lost when surgery gave place to radiation in the treatment of cervical cancer, for in radiated cases the greater radiosensitivity of certain tumors was found to offset their greater inherent malignancy.

The greatest morphologic progress in gynecology has, however, taken place in the field of normal microscopic anatomy which in turn has contributed greatly to

modern physiologic conceptions. Intimations that cyclical changes might occur in the endometrium date back at least to a report of Kundrat and Engelmann published in 1873. Their work remained largely unknown, however, and though some cyclical changes in the uterus were vaguely believed to occur, it was only after the epochal work of Hitschmann and Adler, published in 1908, that the details of the normal changes in the uterine mucosa became a part of the background of all gynecologists. Little in principle has been added to the work of these two men on the normal endometrium, but the recognition of an abnormal pattern, that of endometrial hyperplasia, has added a major entity to gynecologic diseases. For the discovery of this functional disorder and at least its partial explanation medicine is chiefly indebted to Robert Schroeder, but also to Robert Meyer and later to Novak, Wilfred Shaw and to a host of others.

FEMALE REPRODUCTIVE PHYSIOLOGY

Female reproductive physiology was in any modern sense unknown in the nineties. Although it had of course been clear for centuries that the gonads were essential for the developmental changes of puberty, humoral conceptions of physiology were still in disrepute. The year 1888, when Brown-Séquard reported the rejuvenating effects of press juice of testicular tissue, may perhaps be counted as the beginning in the great revolution which has occurred in sex physiology. His extracts were soon followed by others, including an ovarian substance for menopausal symptoms reported by Landau in 1896. That these extracts did not have the properties claimed for them does not detract from their historic importance in giving subsequent investigators a start in the right direction.

After the appearance of the first gland preparations there was little progress for twenty years or more, chiefly because truly satisfactory methods for extraction, concentration and measurement of the hormones were not known. The great advance began again about 1912, the year in which Adler showed that the uterus could be used to demonstrate ovarian activity and Iscovesco found that the active substances in the ovary, corpus luteum and placenta, were soluble in lipoid solvents. These were the essentials needed for the isolation and measurement of the estrogenic hormones, although a different test object, the cells of the vaginal canal of small rodents, was later to displace the uterus as a result of the anatomic investigations of Stockard and Papanicolau (1917), Long and Evans (1922) and Allen (1922).

The discovery of another group of substances of prime importance to the gynecologists occurred rather suddenly in 1926 when Smith and Engle and, quite independently, Aschheim and Zondek reported their observations on the gonadotropic hormones. The work of the latter yielded almost at once a practical test for the diagnosis of early pregnancy. Studies on the gonadotropic substances, their chemistry, physiology and probable multiplicity continue as a field of enormous scientific interest.

That there was a second hormone of the ovary with a different function was fairly evident from early experiments of Fraenkel, published in 1903 and 1910, showing that the removal of the corpus luteum in early pregnancy resulted in abortion. Other early experiments with corpus luteum extracts suggested that they produced secretory changes in the endometrium but it was not until the work of Corner and Allen in 1929 that the duality of the ovarian hormone was finally established.

The clinical gynecologist now looks on with amazement at the rapid changes which are being created in his special field by intruding outsiders, physiologists, chemists and other laboratory scientists. New hormones constantly appear. Testosterone is common to both male and female and the adrenal produces sex hormone-like substances. The estrogens themselves have given birth to subtypes and have been concentrated, crystallized and measured. Their physiologic functions multiply almost daily

and a long list of disturbances have been laid at least theoretically at their door.

From these discoveries has arisen gynecologic endocrinology, a science with no past, a dubious present and a boundless future. No great innovaters can be named here, for the particular steps which may prove important are not yet evident. To date, the greatest service has been rendered by the men who have held back the uncritical. Only in the treatment of the vascular symptoms of the menopause have the new hormones an established position that one may believe will still be held ten years from now. Nevertheless the future is actually limitless and a little terrifying.

PELVIC INFLAMMATION

For inflammatory diseases of the female pelvis the history of the last fifty years has witnessed first a period of youthful surgical exuberance, a few years of sober reckoning and then a persistent growing and determined conservatism. Noeggerath, in 1872, had dramatized the frequency of female gonorrhea, Neisser had discovered the organism in 1879 and soon after Lawson Tait had demonstrated the practicability of salpingectomy. In spite of a high mortality, surgery was the common method of treating pyosalpinx until after the turn of the century. Belief in the invariable necessity of abdominal drainage after these operations added to the problems of convalescence.

Some uncertainty in regard to all this surgery had begun to be felt when in America the trend to conservatism was accelerated by Simpson's rules defining the conditions under which a case of pelvic inflammation was a safe operative risk. Thereafter for years gonorrheal salpingo-oöphoritis was treated largely by bed rest, the patient being entertained during her convalescence by douches, the injection of protein substances varying in character from boiled milk to killed gonococci and by various devices to produce pelvic heat, bags of circulative hot air or water and different types of electric currents. In 1932, Warren and Wilson began reporting work with general fever therapy and in 1935 Domagk described sulfanilamide. Apparently a new era was beginning in the treatment of pelvic inflammation.

RADIATION THERAPY

Radiation therapy has affected no branch of medicine as it has gynecology for two reasons: First, the extraordinary susceptibility of the granulosa cells of the ovary to *x*-ray and radium has made them a most useful agent for affecting ovarian function. The indications, right or wrong of Battey's old castration operation of the eighties have been completely assumed by the pelvic radiologist, who has succeeded also in adding a few new indications of his own. It is, however, in relation to gynecologic cancer, that radiation has had its most revolutionary effect, and it is here that its history can be best traced.

By the year 1890 many operators had undertaken the removal of the uterus for cancer, the name of Freund being particularly associated with the complete abdominal hysterectomy. High cervical amputation and the cautery, a method which persisted for many years (Percy), still vied with hysterectomy as the procedure of choice. At the same time, inspired by the success of Halsted in the treatment of breast cancer, a group of operators were beginning to experiment with more radical procedures (Clark, Ries, Werder). These operations culminated in the extensive abdominal operation of Wertheim (1898) and the comparable procedure by the vaginal approach often named after Schauta. The operability of cases of cervical cancer even when pushed to its limit left from a third to a half of the more advanced cases untreated, while the primary mortality, largely due to peritonitis, varied from 10 to 20 per cent. The operation was, however, a long step forward in increasing the cure rate and it was rapidly taken up in England, France and America.

X-rays were discovered by Röntgen in 1895 and three years later radium by the

Curies. *X*-ray treatment was applied soon after the turn of the century to uterine cancer (Pusey, Pfahler). The use of radium in America began about 1903 (Abbe), but the most important advance was made by Dominici in 1907 when he published his method of ultra penetrating rays developed by means of a metal filter about the radium. Therefore, the lead in radium therapy remained for some years in France.

The subsequent history of the radium treatment of cervical cancer is one of continuous technical improvement based on increased filtration, prolongation of treatment, combination with *x*-rays from multiple ports with divided doses and increased voltage. The work has yielded a slow but steady rise in cure rates but has required a constant increase in the cost and complexity of equipment. As a result cancer of the cervix has gradually moved out of the hands of the general gynecologist into special clinics or hospitals of which the Curie Institute in Paris and Radiumhemmet in Stockholm are among the most celebrated. With this concentration of cases has come a world wide effort to study the disease on a common basis, and before the war a special committee of the League of Nations had laid out rules for the statistical handling of results and was publishing under a single cover the figures on cure rates obtained by various clinics following different technical methods. Thus far had one branch of gynecology evolved since 1891 when William A. Baker was reporting sixteen cases of cervical cancer treated by high amputation.

X-ray and radium have had a place but a much less essential one in the treatment of cancer of the corpus and of the ovaries, where surgical removal is still the essential point in therapy. Radiation has found a definite indication in the treatment of fibroids, but this is limited by the associated destruction of ovarian function. In this respect a swing back toward surgery has been observed in the last few years, perhaps as a concession to the greater value that the new physiology has bestowed on ovarian function.

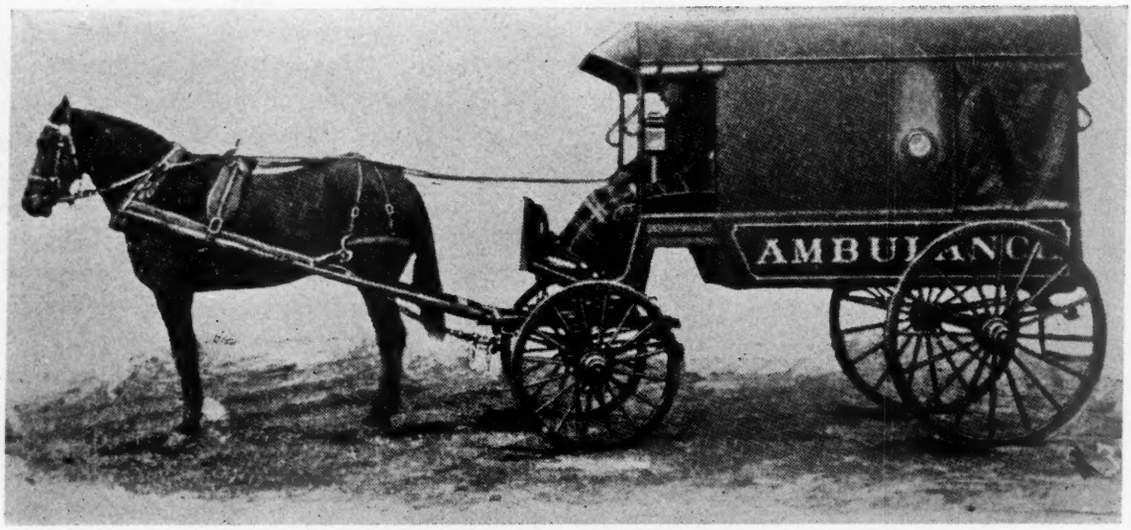
GYNECOLOGIC SURGERY

Although the outlines of modern gynecologic surgery had been sketched a half century ago, advances of considerable importance have none the less continued to be made. Many of these are the forward steps common to all surgery. At the beginning of the period many operations were still done in the home, a practice now all but forgotten in the larger centers. During this period too preoperative preparation was developed and anesthesia became an art. Gloves and face masks appeared. Instruments became fewer in number and were better constructed. Suture material improved in sterility, lightness and durability. Drainage of the abdominal cavity ran a difficult course and finally disappeared as a common practice. Laboratory tests to measure the physical status of the patient, blood pressure, blood counts, blood chemistry, electrocardiograms and a dozen other procedures were developed to guard the patient against unknown risks. These innovations have continued to reduce the mortality rates from gynecologic operations almost to the point of vanishing.

In spite of the greater margin of safety in surgery, conservatism has been a steady trend in gynecology. A brief review of the history of various gynecologic operations suffices to prove this point. The radical operation for uterine cancer has all but been forgotten since the advent of radium. Salpingo-oöphoritis is now subjected to surgery in only a small fraction of the cases and then under circumstances which remove most of the risk to the patient and the excitement to the surgeon. Many fibroids are treated by radiation. Retroversion is conceded to be a tenable position for many uteri. Cystic ovaries are respected as never before and even the cervix is now cauterized or coagulated instead of being amputated.

There have been a few new and important operations. The surgery of uterine

prolapse, as an example, has been developed almost entirely within this period. Before the nineties prolapse was handled by ventrosuspension, by building up the perineum to afford the resting place for a pessary or by the Le Fort operation. The control of descensus by plastic work on the anterior wall and by the elevation of the bladder upon the cervix, the beginning of modern operations for prolapse, was the work of Hadra in 1889 and Sänger in 1892. In America, the principle of upward displacement of the bladder later culminated in the interposition operation of Watkins. This operation was very popular until partly superseded by vaginal hysterectomy with plication of the broad ligaments (Mayo). In England, a procedure known later as the Manchester operation was developed by Donald and Fothergill and brought to America by Shaw in 1933 after it had been common practice in England for many years. This operation made finally clear the prime importance of the parametrial tissues in the support of the uterus, and was therefore essentially different in



The First Ambulance in the World

This first ambulance in the world was initiated into service by Bellevue Hospital, New York City, in 1869. It was designed by Dr. Edward B. Dalton who was a Colonel during the Civil War and worked as an Army Surgeon along the Potomac River.

Bellevue Hospital's Ambulance Today

principle from the various bladder displacing operations. At present these various methods of approach to the problem gradually seem to be finding their own special sets of indications.

Many other surgical procedures might be mentioned. A variety of methods were developed for suspending the uterus (Olshausen, Gilliam, Webster, Baldy, Simpson, Coffey). A valuable operation for cure of endocervicitis was devised by Sturmdorff, although this in itself was less important than the discovery that the proper use of the cautery would usually cure an infected cervix without surgery. The construction by Rubin of an instrument for determining the patency of the tube revolutionized the treatment of sterility and stimulated the working out of a variety of tubal plastic operations.

PAST FAILURES AND THE FUTURE

If one were looking forward from the nineties, one would have hoped that something might have been accomplished in places where no progress has been made. In spite of a new remedy every year, dysmenorrhea is as difficult to treat as it was fifty years ago. Only a quarter or a fifth of all cancer cases live for five years. The psychologic adjustments of marriage, the disorders of the sexual function in the strict sense, are as unsolved, almost as unexamined, as they were in the time of Thomas and Emmett.

To attempt to look into the future is to risk one's peace of mind, and it cannot be said that the prospects are entirely bright for the independent specialty of gynecology whose early history was for a brief period almost that of all surgery. Gynecology has unfortunately no highly technical instrument such as the cystoscope with which to defend itself and it is threatened from many directions. The now standardized operative procedures, such as the hysterectomies and oöphorectomies, are ready to the hand of the general surgeon. The urologist is recapturing the urethra and bladder. Sex hormone endocrinology has become the field of special interest of several prominent teachers of internal medicine, so that hot flushes are no longer the special property of the expert on diseases of women. The radiologist is reaching the point where he can handle cervical cancer with scarcely a gynecologic consultation. Dysmenorrhea and some like conditions are looked upon with interest even by the psychiatrist. What is left is often just enough to occupy the time of the busy obstetrician between deliveries.

With the great days of advance in pelvic surgery past and many of the mysteries of the specialty made apparent to the outsider, it is almost evident that the hope of gynecology is in close union with obstetrics. History has always recognized the close relationship of the two branches and modern trends in education as well as in the organization of medical practice, as typified by the American Board, promise still closer union. As social conceptions continue to increase their hold on the public and medical mind, such a broad specialty which has as its responsibility all the problems of human reproduction, whatever the technics employed, cannot but maintain its high place in the world of medicine.

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FIFTY YEARS OF ORTHOPAEDIC SURGERY

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ORTHOPAEDIC surgery had its development from the same humble origin as did the entire profession of surgery and, like surgery, its practice was quite in accordance with the facilities which science provided at that time. Because of the thorough knowledge of mechanics and the efficiency of the general equipment, and also because of the limited field of surgery, the treatment of those conditions which are now regarded as orthopaedic was very largely mechanical and was in accordance with the thorough knowledge of mechanical principles. Treatment was necessarily limited, however, because of the meager knowledge of pathology and of the character of bone and joint disease, and surgery permitted only a rather limited excursion out of its recognized field. Because of this, it was very largely in the hands of bracemakers, who were many times very skilled in the application of mechanical principles to joint diseases, deformities, the defects of paralyses, etc.

One of the early signs of recognition of the need for segregation in this kind of work was the formation of hospitals devoted to the care of these orthopaedic patients. This was seen early in Europe, where many clinics were started independent of the public hospitals and developed into important and large institutions for treatment. The earliest hospitals in the United States devoted to this special work were in New York, established by the pioneers and were distinctly private institutions.

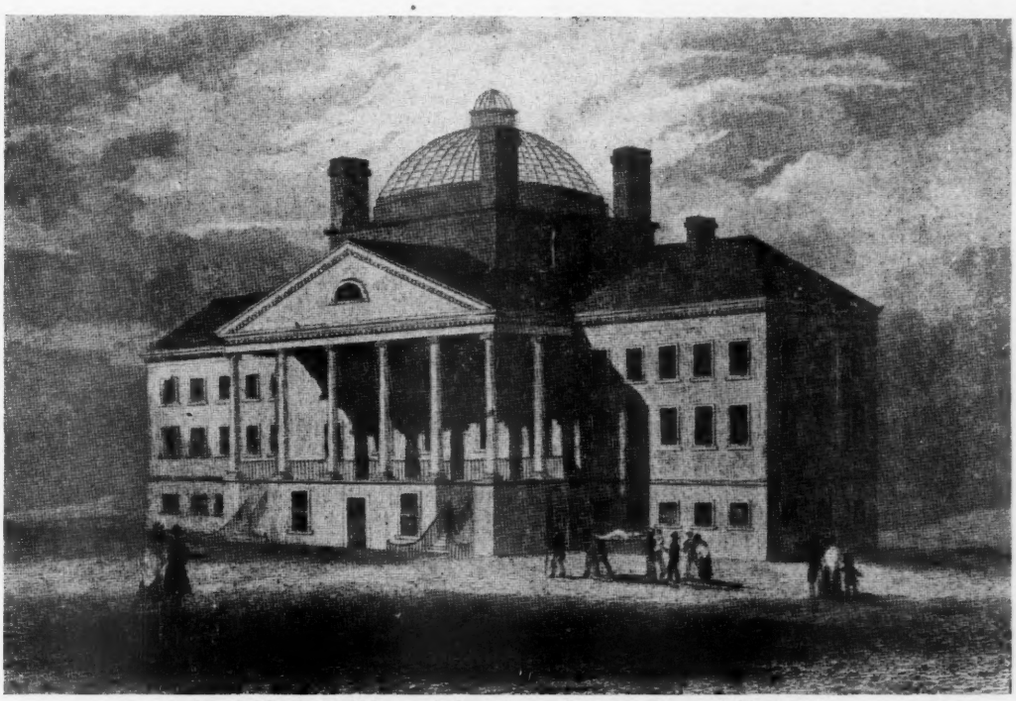
At first the work in all institutions was confined almost entirely to the mechanical treatment of the diseases and conditions. Tenotomies, evacuation of abscess formation in a large number of tuberculous joint diseases, occasional excision and the forceful manipulation (mechanical) of club feet comprised the general scope of their surgery. Later, special hospitals were established for the treatment of these orthopaedic conditions, and now every city of importance has its orthopaedic hospital and the large hospitals have departments devoted to the care of orthopaedic cases. Since the scope of treatment became so greatly enlarged, these departments in the hospitals are now very largely operative; and with the development of the operative side of orthopaedic surgery, mechanical treatment by braces, etc., has gradually become less prominent although not less important.

In this pre-orthopaedic period, the use of appliances was developed to meet clinical demands, although guided by the very limited knowledge of pathology, etc., and it was not until more was known about the progress of disease, and also not until the demand of the people had become much more insistent for improvement in technique and for greater efficiency in the treatment of this group of patients, that the profession began to interest itself in special branches of medicine. The mechanical treatment of these conditions in the early periods gradually merged into a recognized department of medicine.

It took men of strong convictions, determination and foresight to be the pioneers in this evolution, and it required these qualities to take advantage of the increasing knowledge and to apply it toward the refinement of methods which, up to that time, had been limited and somewhat crude.

The conditions which, in general, were recognized as comprising the scope of orthopaedic surgery were the tubercular joint diseases (other forms were not, at that time, differentiated), some of the chronic rheumatic affections, deformities—congenital and acquired—including deformities and defects following infantile paralysis,

flatfoot and many of the malunited and nonunited fractures. The added interest of these men in the treatment of patients with tubercular joints which, at that period, was mainly mechanical, evidently stimulated the refinement of the apparatus and brace treatment of the other conditions which were coming under their guidance, and this method of therapy fifty years ago reached a high degree of proficiency and excellence, both in the intelligent employment of the principles of mechanics and in the types of apparatus used.



The Bulfinch Building of the Massachusetts General Hospital.

This probably prepared the stage for the next step in advance, which came with the advent of the new principles of antiseptic surgery, which opened up a new field of work. The advances made in the treatment of this group of conditions were dependent upon many factors, but the first and most important must be considered as those advances in surgery which enlarged the field of operation and allowed a precision in obtaining results. Heretofore, operations had been limited mainly to tenotomies and those of like magnitude. The other factor in the enlargement of the scope of orthopaedic work and in the success of the treatment following antiseptic surgery, which increased the facilities and the knowledge of bone processes, and which has almost revolutionized diagnosis and has added precision to the treatment, was the *x*-ray. Probably the influence of the *x*-ray was felt in the study of bone earlier than in any other department of medicine, and at first it was thought that its use would be limited to bone conditions; but, combined with the results of the new field of research opened up by biochemistry, it has made as complete a revolution in the scope of the understanding and the capacity for treatment as in any other department of medicine or surgery.

Surgery of the bones and of the cavity of the joints, as well as of the cavity of the abdomen, was not regarded as within the limits of safe or justifiable surgery. Even the abdominal cavity emerged from this "No Man's Land" before the joint cavity yielded to antiseptic surgery. As has often been the case in the history of medicine, increased knowledge which came with the gradual development of medicine and surgery allowed the more intelligent and wider use of methods which had previously been

carried on only in crude form; and since these advances were recognized throughout the whole world, we find the development appearing almost simultaneously in orthopaedic surgery in places widely separated.

It is often interesting to observe how a new interpretation of disease, a conception of pathologic processes and departure from the conventional methods of treatment may appear in different parts of the world at the same time. Discoveries in medical science are so widely distributed, that advances made possible through this added knowledge and increased facilities for study and diagnosis are recognized by workers all over the world at the same time, and the developments which mark progress are often reported simultaneously by observers in different parts of the world. Claims of priority are often but an indication of the stage of development that medical science has reached.

The need of careful observation and study, in place of the more elaborate means of investigation and laboratory proof of today, developed a group of men who were keen observers and who were able to interpret with remarkable accuracy the clinical evidence of disease. It is not that the medical and surgical men of today are less resourceful than were those in the early periods, but, rather, the limited means at that time demanded the fullest use of the facilities at hand, and developed men of unusual courage to invade the "No Man's Land" in surgery in their attempts to provide relief. There was a lack of feeling of security in the advances first made, that, with the facilities and laboratory aids of today, is no longer present. Laboratory and other like means to aid and to guide in diagnosis were few, and these men had the capacity for quickly sizing-up the essentials with amazingly accurate judgment. They were masters of the means at their disposal and of the facilities which medical science of this period afforded to them; and in the application of this knowledge to the individual, they possessed a capacity for clinical judgment often lacking now, when dependence on complicated and elaborate means of diagnosis tends to limit greatly the personal equation, which supplies the ability to estimate the relative values of clinical and laboratory evidence and to adapt it to the individual. The constant employment and dependence on accurate scientific data in detecting morbid processes often leaves the application of the personal equation to the individual somewhat of a detached factor.

The ravages of the tubercular diseases of joints were causing insistent demands for more accurate and more efficient methods of treatment, which stimulated the inclusion of other conditions whose demands, although important, were, perhaps, less insistent. Hilton, in his book on "Rest and Pain," had brought into prominence the doctrine of rest as essential for repair and this doctrine at that time enjoyed practically universal acceptance. A few men with more than the ordinary foresight and intuitiveness recognized the opportunities. In America, there were two men in particular of strong convictions and with decided opinions who stood out pre-eminently as the leaders in this movement. It is to these men that credit must be given freely for bringing the treatment of these diseases into a position of a recognized specialty. Each was the strong advocate of his own method of obtaining this necessary rest and, although their methods were different, they were both working toward the same end. The efforts of these pioneers were met, as were other departures in medicine, with definite opposition, but their belief in their chosen work and their persistence never wavered. This opposition may have retarded the rapidity but it served to strengthen the growth of the specialty; for the slower growth allowed it to be woven more securely into the warp, and it became an integral part of the domain of surgery instead of a side issue.

In these early periods, practically all of the joint diseases were considered tuberculous, and it was not until much later that it was proved by adequate facilities of

diagnosis that many of the reported cases in which different methods were employed were other forms of infection from other bacilli, chemical toxemia, etc. Progress in surgery has made the problem of diagnosis in early affections of joint disease increasingly difficult and often possible only after long study and investigation. The patient, on the other hand, has reaped the reward that science has bestowed.

Because of the prevalence of tuberculous joint disease, the work of these two men was largely identified with this problem, and in following out the ideas of Hilton they established the two methods or means of treatment. One of these obtained rest by the use of plaster of Paris, and the other, by the use of braces combined when possible with traction. Both men were of unusual intelligence and skill, and they brought these two methods of treatment of joint diseases to the highest degree of excellence—almost to perfection. Others have made claims of priority, whether with justice or not, in the use of these forms of treatment; but these two men demonstrated these methods of attaining rest by fixation and by traction and made them available to the medical public. Both have had and continue to have their strong adherents in this and in foreign countries.

With the increased knowledge of disease and with the added facilities for study and for diagnosis, the general acceptance of the aim in the treatment of these conditions has gradually eliminated discussion in regard to the means by which it should be obtained. At that early period the cure of tuberculous joint disease was sought in long continued rest with the endeavor to retain some motion. Probably it is in this object of treatment that the most radical change has been apparent, for time has demonstrated that the cure with slight motion of tuberculous joints in which destruction of the joint areas has occurred, is not always safe in later life, and it is, therefore, generally accepted that bony ankylosis of a tuberculous joint assures the most dependable result in after-lile. Cures were obtained only after long, persistent, conservative treatment, often with continuous sinuses and copious discharge in the more severe cases. Amputation was not an unusual final procedure to eliminate the disease or to save life. Excision of the involved areas was practised for a time, with some, but not marked, improvement in the results, and the after-treatment was necessarily continued a long time. On the other hand, it must be remembered that the mechanical treatment was frequently so efficient that satisfactory results were obtained in a surprisingly large percentage of cases.

The estimate of what constitutes a cure of destructive tuberculous disease has undergone a definite change in the past two decades. Relapses of cases supposedly cured were continually encountered, due to the stress of the demands of adult life. Motion in joints, which have been the seat of previous destructive disease, even after long periods of quiescence must be considered as frequently being a source of danger. The increased knowledge of the unsafe condition of partly cured areas which have been the seat of destructive disease has resulted in the general acceptance that bony ankylosis affords the most dependable, although perhaps the least convenient, joint. By anticipating Nature's best result and producing an ankylosis by operation at the proper time, early in the course of the disease, months and years of conservative treatment are eliminated and a more dependable cure is obtained. That the age of the patient and the stage of the disease are both questions which still require experience is a generally accepted opinion, but the method is already fruitful of definite progress.

No greater change has been recorded during the past fifty years than that of the prevalence of tuberculous joint diseases. Tuberculosis formed the bulk of the practice of orthopaedic surgery in the early days of the specialty, both in the clinics and in the private practice of orthopaedic surgeons, and produced the severest types of

cases with extensive disease. During the last decades, the prevalence of tuberculous joint disease has so diminished that it now forms only a small part of both hospital and private practice, and the large group of suppurating cases requiring daily dressings no longer constitutes the larger part of the daily hospital routine. The change in this picture has come because of several important factors: the elimination of the source of infection from bovine tuberculosis, improved hygienic conditions, recognition of the danger of contact contagion, the beneficial effects of heliotherapy and the recognition of the general rather than the local character of the disease, all of which have contributed to the extraordinary diminution in its prevalence.

Progressive workers in this field of surgery have taken quick advantage of the opportunities to develop this field of work which modern surgery and the *x*-ray have furnished. The growth in its scope and efficiency is illustrated by a brief survey of some of the more important conditions which come under the care of this group, and the changes indicate the steps or the stages through which they have passed in the progress.

The surgery of joints presents one of the more striking examples. Arthrodesis, at first interarticular, later extra-articular, was the first and perhaps the least difficult procedure, particularly in its contribution in the extra-articular arthrodesis applied to tuberculous joints. The mobilization rather than the immobilization of joints met with a greater obstacle. A demonstration of this is seen in the gradual evolution of the operation for arthroplasty, beginning with crude and at that time courageous attempts to prevent the union of freshly denuded bone surfaces by the interposition of some material. Among the first of these materials was celluloid; later slowly absorbing membranes, including fascia lata were used with some degree of success, and now with the increased knowledge and understanding of nonirritating alloys, metal between freshly denuded bone surfaces is employed.

In the early periods, Scoliosis was a subject which developed a great deal of interest and occupied the attention of a large number of orthopaedic surgeons. This deformity had intrigued some of the most accurate and intelligent investigators, particularly in the study of its etiology and development. The interest in scoliosis also stimulated attention to the posture of children and extended to the care and treatment of growing children in school.

The treatments for these two conditions were very often grouped together. At first the treatment was necessarily limited to the employment of mechanical appliances and the different forms of physiotherapy, including gymnastic exercise. Both the mechanical and physiotherapy treatment attained a high degree of efficiency, probably because in this pre-operative period, treatment was necessarily restricted to these methods. A great deal of dependence was placed on the beneficial effect of exercise and this form of treatment was highly developed. There were many schools of treatment by gymnastic exercise, the principles of which were directed toward the correction of the curves as well as toward readjustment of muscle control. As in other affections, this treatment was most efficient in the milder forms, but the severer cases proved to be definitely intractable.

It was at this time that the principle of primary correction of rigidity of the curves by both forcible physical exercise and mechanical appliances was advocated and developed to a high degree of efficiency. This marked an important step in the progress of the treatment of this difficult problem. For this purpose, strenuous exercises were used, but more dependence was placed upon and more definite results were obtained by the various mechanical devices, the force of which was directed toward producing traction and de-rotation. The amount of force which it was found practical to use by this means—since the amount and direction could be controlled accurately—was remarkable.

The use of plaster of Paris jackets applied with mechanical aid to obtain a forcible de-rotation was, perhaps, one of the important steps in the development of more vigorous methods, and was distinctly popular for a time. It certainly stimulated a renewed interest in the treatment of this condition which had begun to wane. The continued use of this principle has developed the employment of jointed plaster of Paris appliances, which allows the treatment to be carried on with the other forms of therapy, such as exercise, etc. The difficulty of treating the more severe cases and the urgent need to prevent the increase in some of the more pronounced, intractable cases—particularly those associated with paralysis, usually infantile—as well as to prevent the development of the deformity in some of the younger patients, stimulated the more active treatment by fusion operation, and is a demonstration of one result of the added facilities offered by the advent of antiseptic surgery.

Fusion by different types of operation in order to solidify an area subjected to stress by the superincumbent weight and an uneven musculature was first performed in 1931. This method should not be considered as entirely new in principle, but rather a method grafted on to the older and recognized forms of treatment, in order to shorten the treatment and give more definite results in those cases which are not amenable to the other conservative methods. The age of selection and the security on which dependence can be put in the after periods, etc., have not yet been definitely agreed upon by all observers. The strong advocates are not of uniform opinion on some of these important questions, but evidence is continually collecting from the experiences of these observers which will eventually lead to uniformity. The older forms of treatment are still actively employed.

The treatment of Congenital Dislocation of the Hip is an example of what has been accomplished in the care of this difficult problem, particularly by the persistent endeavors of comparatively few who firmly believed in the possibility of its solution. At that time, this condition was held to be one of the most difficult to relieve and one of the most impractical to correct. Reduction was by no means certain and retention was less so. Today the care of this condition is approached with confidence, and the methods of treatment, made practicable through the opportunities of surgery and the guidance of the *x*-ray, have resulted in the development of means to include the older cases in the group, and to give relief at least, if not cure, in the majority of even these cases.

The solution of the problem of actual reduction was sooner achieved than the agreement on the choice of methods, and the recognition of the later abnormalities developing in the joint as a result of the trauma which is a part of the treatment with many of them. During the early practice in the reduction, the manipulative methods were universally in vogue, and found strong advocates of the different procedures for the replacement and for the general technique of after-care. The results showed only partial success, and the failures developed earnest advocates of open reduction even in the younger cases, which proved to be a step toward the recognition of a more secure means of replacement and of retention in the large percentage of cases. They claimed for this method less trauma and a greater surety of replacement and retention. Each of these groups contributed toward the sum total of the solution of the problem, and has made possible a satisfactory agreement in regard to the general conduct of these cases. The possibilities of modern surgery and roentgenology have yielded the greatest contribution to this present satisfactory solution of the problem.

A study of the clinical course of these cases operated on by manipulation, with its traumatic technique or by open operation, shows the degenerative changes of misshapen femoral heads, etc., and this has been the influential factor in the gradual adoption of the present methods of dealing

with this group of cases. These late results were not recognized for many years, and the knowledge of these final results probably was the important factor which led to the more frequent adoption of the open method for the difficult cases as being more definite and less harmful in technique. Manipulation is used but is guided by the knowledge of the later possible degenerative changes as a result of undue trauma. Open reduction, with improved avenues of approach, may be resorted to earlier. Modern surgery, aided by better understanding of joint conditions, as shown by the *x*-ray, has extended the treatment to older and adult cases, mainly by the "shelf" method, which affords an area of impingement for the head, thus allowing firm weightbearing even with a definitely imperfect acetabulum.

The frequent and severe epidemics of Acute Anterior Poliomyelitis have furnished an extensive field for research and experience in the treatment of the defects which supervene on these paralyses. First stimulated by the individual interest, and later aided by societies sponsored by private interests, and still later by State and Federal organizations, the advantages which have been brought to those whose capacity has been impaired by the results of this disease, have been one of the most remarkable phases in the results of its treatment.

The special benefits which have come to the patient with paralytic defects and deformities are the result of the more accurate technique of tendon transplantation, the greater insistence upon the preservation of the integrity of the tendons and their sheaths, the more careful choice in the selection of cases for the transference and the greater caution and better judgment in selection of the age for operation. Astragalectomy, one of the earlier radical operations, proved its value in a large number of cases before other bone operations were advocated. The stabilizing operations, used either alone or combined with tendon transplantation, afford security in the absence of sufficient muscle power and in the prevention of the development of deformity from mal-weight-bearing and mal-balance of muscle pull. The operative field in later years has offered the greatest opportunity for more efficient methods, just as the mechanical treatment, which had so much more attention in the pre-operative period, became highly developed and efficient. The insistence on rest and the avoidance of overfatigue of weakened muscles during the active treatment period, particularly in the physiotherapy which accompanies all treatment of these cases, indicates the broader and more comprehensive viewpoint in meeting the problem of treating this complex condition.

There is no subject which has recorded a more complete change than that which is evident in the methods and in the success of the treatment of Fracture of the Neck of the Femur. The literature of fifty years ago gave only a most discouraging outlook for a successful result and little encouragement for the future. Union was almost the exception. The first advance was made by the introduction of the abduction method of replacement and retention in plaster, which was a radical departure from the usual treatment and did not follow any definite principle; and this marked a distinct beginning in the progress which has continued until today, when the results are now as reliable as in almost any surgical procedure. The time of treatment is reduced to a much shorter period, the patient is allowed ease during this shortened period of treatment and is given the assurance of a reasonable degree of success, even the aged. Recent factors of importance are the more accurate method of reduction, the more precise means of detection of the reduction and of the retention, with which the percentage of successful results has steadily risen.

The greater advance which has nearly revolutionized the definiteness of treatment is a result of the opportunity which modern surgery has afforded for operation—by the

opportunity to employ the open method, first to obtain fixation by means of the graft. It was in the older, ununited cases that this improvement first took place. Retention by nails was first performed many years ago by the simple spiking, and the renewal of its use marked the beginning of the most important advance in the surgical treatment of this injury in the fresh as in the old ununited cases. In following this principle, many forms of nail fixation of the head were used by the investigators in this special subject, varying in number from one to several, and in size from the large spike to the Kirschner wire. Both the results obtained and the shortening of postoperative recumbency from months to days justified the endeavors.

The development of nonirritating metals —both in the fresh and in the older cases— the use of the flanged in place of the plain nail and the variety in the types of screws used for the fixation of the femoral head have brought the treatment of this injury to a procedure of precision and of definite results. The type of device for fixation and also of the many ingenious mechanisms used for guidance in placing the metal are still matters of individual choice and of familiarity with the method; but excellent results are obtained by them all in skilled hands, and in place of recumbency of from two to four months, the patient is often allowed out of bed in a few days.

The World War brought into sudden demand the resources for the care of these bone and joint diseases and injuries, and one that required all the experience available to care for these conditions in bulk. All surgery responded, and orthopaedic surgery was organized to develop the necessary equipment to meet the demands upon it both in personnel and in materials. The different departments under which the work was carried on responded to the call, and the mutual working-out of the problems resulted in a close relation and cooperation and helped to establish the accepted position of orthopaedic surgery in the medical field. The recognition of the contribution which general surgery had to give to orthopaedic surgery and the special contribution which orthopaedic surgery had to offer to general surgical practice have resulted not only in the development of more accurate and satisfactory methods of treatment but have added greatly to the successful care of these cases.

With the very active development of the work in industrial surgery, a large part of this traumatic work is directed toward the care of injuries, particularly of the bones and joints, and experience during the War has aided, in a large degree, the development of this specialty. The close similarity between the conditions and the methods of treatment in the so-called "orthopaedic" and so-called "traumatic" cases has resulted in an enlargement of both of these departments of medicine. This has already tended toward the drawing of less fine distinctions in the scope or the limits of the specialty and toward the acceptance of the understanding that the science of surgery has the responsibility of caring for the conditions requiring attention, and that the duties of one of its special departments are to produce an equipment and a personnel, fitted by study and experience, to give the best treatment to the cases which are relegated as coming under its care. This cooperation insures the grouping of the best from all the facilities which medicine and science are able to bring to the benefit of the patient.

The medical societies have been one of the most beneficial influences in the development of the character of the work in the formative period and in the recognition of the necessity for segregation to a special group much of this department of surgery. In 1887, a small group of orthopaedic surgeons in the eastern states formed the American Orthopaedic Association, which proved to be an important move in the establishment and recognition of orthopaedic surgery as a specialty, and in the formulation of the group of cases which was considered as coming under the scope of this department. It furnished an oppor-

tunity for the advocates of the different methods of treatment to discuss their theories and ideas in that early period of the specialty when the general rules of procedure had not yet been established and opinions were widely separated. The membership of this charter group consisted of thirty-five surgeons and was limited to those exclusively engaged in the practice of orthopaedic surgery. The wisdom of its organization was demonstrated by its immediate success. The membership was limited in numbers in order to confine its interests to purely orthopaedic problems at its annual meetings, which were held in the home city of its president of that year. Expansion in numbers and in territory marked the increasing interest in this group of diseases and the greater recognition of its need. With the increasing number of orthopaedic surgeons, the limit of its membership was gradually raised, and at the present time there is an active membership of 147 distributed throughout the United States and Canada. Its membership is still limited to those who confine themselves to the practice of this specialty.

There was a rapidly increasing number of surgeons who became interested in the problems of bone, joint and traumatic surgery, and the development of industrial surgery added very materially to this list as well as to the need for thorough study of the problems connected with these injuries and the conditions which followed them. There was evidently a desire by a large number of these men all over the country for the opportunity to attend meetings in which problems of this character were being discussed. In 1934, to meet this demand, the American Academy of Orthopaedic Surgeons was organized with a charter membership of 425. The members of this organization were not necessarily those who limited themselves exclusively to the practice of orthopaedic surgery, but were those interested in bone, joint and traumatic surgery as well as purely orthopaedic problems. This move met with an immediate response, for it presented an opportunity for a large number to hear the papers which were delivered and to benefit from their enthusiastic meetings. The Academy has since had its annual meetings with increasing attendance and increasing membership, and has played an active part in the development of the position of orthopaedic surgery during the past few years. It has now an active membership of 641.

In 1934, the American Board of Orthopaedic Surgery was incorporated. It was organized on the same plan as other departments of medicine which had previously established similar committees. The duty of this organization is to designate the necessary requirements for recognition in orthopaedic surgery and to standardize these requirements for membership in the two recognized societies. Its officers are members of the American Orthopaedic Association and the American Academy of Orthopaedic Surgeons, and this Board conducts annual examinations for membership. It has now been established that all applicants for membership in either of these two societies shall be required to have passed the Board examination in order to be accepted as candidates. Those who pass may then be elected in accordance with the requirements established by each Society.

During the last two decades, the formation of societies which have for their object the provision of treatment for crippled children has represented one of the activities relative to this specialty. With the increased amount of interest and added possibilities for treatment of this group of crippled children, segregation into special groups became necessary to carry on the large bulk of the work and to provide special means of treatment for the large number of cases.

The first society of this kind originated in 1931 and its object was to bring to crippled children the means of treatment for their physical defects and to provide for their education and occupational training which might be used for support later on. It

made no attempt to treat or to provide any special means of treatment, but rather to bring the children to those institutions already organized where this could be carried out. It was found that a large number of cases were throughout the country, and a survey made in different regions disclosed a large number who had never had an opportunity for treatment, either because of ignorance of the opportunities or because of inability to avail themselves of them. The work of this society grew rapidly and it has now become an international association.

This society probably stimulated the formation of other societies with like objects and like methods, so that there are now many societies scattered throughout this country, some independent and others connected with the communities, working in conjunction with recognized institutions and also with the Federal Bureau which was established in 1935 to aid in the care of crippled children. The same plan has been operative in many foreign countries, usually working with the national societies. The whole movement originated in response to the recognition of the great need for and also lack of care among this group of individuals, and also of the necessity for providing some means of bringing into contact with the opportunities for treatment which already existed a very large number of those individuals in all parts of the country for whom no treatment had been available. This lack was either a result of the ignorance of relief that was available to this group of cripples or because of the inability of the parents to provide the opportunity for them.

As with other specialties, there has been much discussion in reference to the scope of conditions to be grouped under this department. To confine the borders or limits in this way is not satisfactory nor is it possible. In orthopaedic surgery there can be no anatomic grouping as in some of the special departments of medicine and surgery, nor does it include all of the infections of any component structure (such as bone, etc.), but it deals rather with principles of treatment and with the correction of faults and defects which involve the coordination of many parts of the entire body. The specialty today implies special knowledge and equipment which will enable an orthopaedic surgeon to care for in the most efficient way and with the best ultimate results the conditions which he accepts to treat. So often the task includes the working out of a problem involving several stages requiring different forms of treatment and demanding long-continued care rather than following a recognized surgical procedure. The horizon is limited by the personal equipment and skill, gained by special study and experience, that the orthopaedic surgeon can bring to the task.

FIFTY YEARS' PROGRESS IN UROLOGY*

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TO do justice to the remarkable advances made in urology during the past fifty years is an impossible task. There is no branch of medicine in which embryology, endocrinology, comparative and regional anatomy, bacteriology and other forms of laboratory investigation play so important a role. The *armamentarium urologicum* with the developments of cystoscopic instruments is a vast field in itself. The scientific papers on urologic subjects comprise hundreds of thousands of items. This survey, confined within the scope of a journal article, cannot include more than a small percentage of even the important papers. I am aware that many which should have been discussed have been missed.

It seemed advisable to ascertain what the status of urology was before the period under discussion. It has been portrayed in an encyclopedic manner in Volume I of Prince Morrow's "System of Genito-Urinary Diseases, Syphilology and Dermatology." The first volume of 1,074 pages of this epoch-making System (1893) contains exhaustive treatises by thirty-two of the leading genito-urinary surgeons in America. The majority of the writers were men of distinction and occupied professional chairs in the great medical schools of America. In the space allotted to this article, it is impossible even to refer briefly to the contents of this volume which has played such an important role in the development of urology in this country and which, in my early days, furnished me with a great inspiration. It is still a fountain source of information which should make it a "must" reading for all students of urology.

The chapter on diseases of the penis came from the pen of our revered Ramon Guiteras. Only minor operations were done. Cancer was treated mostly by amputation; extensive resection and removal of the glands were not even considered. Circumcision occupies many pages and balanoposthitis many more.

"Diseases and Injury of the Urethra" by F. Tilden Brown, one of the greatest of early cystoscopists, is still interesting reading and applicable to modern urology. Duplay's operation for hypospadias is given in detail. His methods are still of fundamental importance and do not differ very greatly from modern practice. Thiersch's modifications of Duplay's work for hypospadias and epispadias had already appeared and profoundly affected the surgery of these conditions for many years. Rupture of the urethra was handled effectively by perineal operations. Suturing of the severed portions of the urethra was advocated when it occurred in front of the triangular ligament, but apparently no operative attack was considered when the rupture was behind the triangular ligament at the juncture of the membranous and prostatic urethra. Suprapubic drainage was apparently all that was thought of at that time. For strictures and fistulae the surgery was good and not very different from that of today.

Although the gonococcus had been discovered only eleven years before, great progress had already been made in the bacteriology of the urinary tract and antiseptic treatment. Deep seated lesions of gonococci were discussed by George Emerson Brewer in a classical chapter. The chapter by William K. Otis on chronic gonorrhea is still important reading.

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The endoscopic pictures in color which accompany Herman G. Klotz's chapter on endoscopy of that day are still interesting.

Seventy pages are devoted to stricture of the urethra by J. William White. With lovely illustrations and excellent surgical advice, it leaves little to be added by moderns.

William T. Belfield discusses "Diseases of the Prostate." This is an important article by the father of modern prostatectomy. He devotes many pages to local treatment, catheterization, etc. He says that in a considerable number of patients palliative measures fail to avert constant suffering and a fatal result. These cases were formerly regarded as beyond surgical cure; aside from the relief obtained by suprapubic puncture, they were abandoned as hopeless. As Belfield says:

> The theory of the radical operation assumes that the cause of chronic retention is mechanical obstruction by the enlarged prostate; that such prostatic obstacles are capable of removal; and that after such removal the bladder will resume its function of voluntary evacuation.
>
> These propositions have been denied by three of the foremost among living genito-urinary surgeons—Thompson, Guyon and Socin, but Guyon made his first attempt [to remove an obstructing prostate] in July, 1899 and found a prostatic growth readily removed. The accumulated clinical observations of the past five years prove that these traditions of the earlier surgeons, upheld by Guyon and Thompson, which have dominated surgical opinion and practice, must be restricted to a minority only of prostatics; for it is clearly demonstrated:
>
> That there is a larger class, entirely distinct from these, in whom the failure to evacuate the bladder is due in no wise to degeneration of the vesical muscles, but solely to the mechanical obstruction offered by prostatic growths; since the removal of such obstacles has been followed in over three fourths of the cases previously dependent upon the catheter by restoration of the vesical functions.
>
> That the prostatic obstruction is usually, contrary to the opinions of Guyon and Thompson, of such form as to permit excision, is shown by the fact that in four fifths of the cases of suprapubic incision such obstacles were found and removed.
>
> It is proved that in many prostatics the source of the evil is to be sought not in sclerosis or senile degeneration of the bladder, but in mechanical obstruction by prostatic tumors; that these tumors are not a product of sclerosis, nor of senility, nor even limited to advanced life; . . . that these tumors are in most instances susceptible to removal; and that in such cases a well-executed radical operation restores voluntary urination.
>
> It is indisputable, however, that in many prostatics of advanced age arteriosclerosis and degeneration of the vesical walls coexist; the contractility of the bladder is seriously impaired, and removal of the prostatic obstruction fails to restore voluntary evacuation of the organ. It is important to differentiate between the obstruction and degenerative factors.
>
> Prostatic obstacles to urination have been attacked by four routes: (1) urethra, Mercier, Bottini; (2) perineal incisions, Harrison, Keyes, Dittel; (3) suprapubic cystotomy, Belfield, McGill; (4) combined perineal and suprapubic incisions, Belfield. [Belfield shows that Mercier's and Bottini's methods are unsatisfactory.]
>
> Perineal urethrotomy has been employed in some forty cases as the avenue of access to the prostatic obstacle. Small median tumors (middle lobes); transverse overgrowths (bars at the bladder neck) have been incised and excised; even lateral masses of considerable size have been enucleated (Wishard). Yet many cases are not capable of satisfactory treatment by this incision; the elongation and rigidity of the prostatic urethra prevent complete operation or even exploration at the bladder neck.
>
> Suprapubic cystotomy seemed at first to fulfill every requirement. . . . Prostatectomy by this incision has been performed over eighty times with satisfaction to the operator, and often with results most gratifying to the patient. Yet in several instances this operation has failed to detect or to remove the prostatic obstruction. It seems therefore that the combined operation by both suprapubic and perineal incisions should be the rule. . . .
>
> The results of the various radical operations have been carefully collected and discussed by Watson. . . . About one hundred and fifty cases are now on record. . . . In about three

fourths of the cases voluntary urination has been restored in patients previously dependent upon the cathether. . . . The mortality of prostatectomy is about 13 per cent. . . .

The salient points in prostatectomy may thus be enumerated: After suprapubic incision further procedures are determined by the size and location of the growths. Pedicled tumors, such as middle lobes, are removed by cautery wire, snare, tonsillotome or scissors. . . . Sessile tumors, such as lateral lobes, can be enucleated by a finger or spoon after the mucous membrane is incised. Protruding parts of the prostate that can be neither excised nor enucleated safely should be treated by sinking a cautery point into them. . . . Usually a suburethral growth is found; a perineal urethrotomy is then made, one forefinger inserted through the incision and the other through the vesical orifice until they meet; obstructions detected are removed according to indications, since the object of the operation is to restore a low-level, unobstructed channel from the bladder to the membranous urethra. The suprapubic wound may often be closed, except for drainage of the prevesical space, and the bladder drained by a large perineal tube extending at least an inch into the vesical cavity . . .

The safest and simplest method of drainage is puncture from the perineum through the prostate, with little or no anesthesia. . . . Between these extremes—the radical operation and perineal puncture—are several measures of intermediate gravity, one of which may be selected according to the vitality and needs of the patient: (1) perineal prostatotomy after Harrison, i.e., urethrotomy, incision of the urethral floor at the vesical orifice, drainage for six to twelve weeks through a large tube. (A distinct middle lobe would naturally be removed when easily accessible); perineal urethrotomy or suprapubic cystotomy for drainage, temporary or permanent.

This article by Belfield, written in 1891, probably was an accurate statement of the attitude of the most advanced surgical urologists in the treatment of prostatic hypertrophy.

In discussing cancer of the prostate, Belfield says, "Cancer of the prostate frequently fails of recognition, partly from neglect to make digital examination per rectum, partly because cancerous enlargement is not distinguished from the more frequent and familiar hypertrophy of the prostate." Belfield says, "Extirpation of the cancerous prostate has been performed ten times; the patients who survive the operation have all died of recurrence within a few months."

The chapter on cystoscopy was by Dr. Willy Meyer, a urological surgeon who had already published several papers on the cystoscope. Meyer's chapter is a classic and presents in a thorough way the history of the first ten years since the invention of the cystoscope by Nitze.

Meyer describes Brenner's modification for catheterizing ureters. Brenner used Nitze's cystoscope No. 2 in which the operator looked directly straight ahead through a window on the convex surface of the beak. Brenner provided a small channel on the convex side of the shaft through which a catheter or sound could be passed with the object of its introduction into the ureter. Brenner thus succeeded in pushing the catheter into each ureter of a female patient but failed to do the same in the male. Meyer remarked: "The instrument in its present shape is useless, especially in the male." He makes no mention of the successful use of DuRocher's instrument in catheterizing ureters.

In regard to the use of the cystoscope in diseases of the kidney Meyer says, "The diagnostic capabilities of the cystoscope are not limited to diseases of the bladder, but extend to those of the kidney. Not only can we often localize the seat of the trouble—negative vesical evidence giving a positive diagnosis of renal disease—or distinguish whether there are two working kidneys, whether both are affected or only one, and then which of the two. All this is accomplished by observing the character of the jets of urine at the ureteral orifices (transparency, color), timing their frequency and duration, and also by noting the position, shape and injection of the ureteral orifice itself in comparison with that of its fellow." A few cases illustrating these points were

cited, viz.: renal hematuria and renal pyuria.

Meyer discusses at length the great desirability of having a successful ureter catheterizing cystoscope. "All cystoscopists are anxiously awaiting a cystoscope for catheterizing the ureters. . . . Nitze should give it to us." Meyer thus ends his chapter.

In a chapter on "The Cystites," Samuel Alexander, one of the most scientific young urologists in America, presented an excellent discussion. He said, "The study of microbes found in the urinary tract was begun by Pasteur. His discovery in 1859 of the micrococcus ureae, and the investigations subsequently made by Van Tieghem as to the power of this microbe to cause decomposition of urine, attracted widespread attention to the study of the pathogenic microbes in the urinary apparatus . . . From the discovery of the micrococcus ureae in 1859 to the present time (1891), no less than thirty species of micro-organisms have been found in pathologic urine."

Alexander stressed the danger of introducing bacteria with instruments and insists not only on thorough cleansing of the external genitalia, but says the pendulous and bulbous portions of the urethra should be thoroughly irrigated with Thiersch's solution.

In a chapter on "Injuries of the Bladder," George R. Fowler gave the statistics of Bartels. In 285 cases of gunshot wounds of the bladder, there were about sixty-five fatal results, while in 185 cases of rupture, only seventeen ended in recovery. The statistics of the Civil War, Fowler said, showed a higher mortality in the gunshot wounds, there being ninety-six deaths in 185 cases. In intraperitoneal wounds, Fowler advised immediate laparotomy and suture of the bladder wound. For extraperitoneal wounds of the bladder, he advised exploring the original wound and the insertion of a proper drainage tube. Fowler describes operative methods that have been used in cases of exstrophy. He advised taking flaps from the abdominal wall and making a new urethra by the method of Thiersch. He says, "The hope of benefit to be derived is solely that an apparatus may be worn to catch the urine with greater facility. There must be of necessity incontinence, as nothing has as yet been devised to take the place of the sphincter vesicae."

The fear of getting into the peritoneum seems to have been very great. In 1888, Helferich proposed resection of the symphysis pubis for the removal of tumors and stones, and Langebuch the same year proposed another route to the bladder which he called "sectio alta subpubica." After the penis was loosened from its attachments the operator went beneath the symphysis to reach the bladder. For tumors of the bladder in the female, incision through the vagina, or colpocystotomy, was favored by some, rather than the suprapubic route. It seems remarkable to us now, when suprapubic cystotomy is considered such a simple operation and so free from danger, that the early operators seemed to fear getting into the peritoneum and went to such extraordinary lengths to reach the bladder by other routes.

Up to 1891, Francis S. Watson was able to report eleven cases of benign tumors which had been treated by operation, in addition to forty-one recently reported by Sir Henry Thompson. In only seven cases had there been no reappearance of symptoms of any kind for three years or more. In three cases the growth had been removed by forceps through a perineal incision. In one female case, the tumor was removed after dilatation of the urethra. In only three cases was suprapubic operation considered necessary. Fifteen patients had died; nineteen were alive less than four years. In the eleven cases of benign growths which Watson collected from various operators, death or recurrence had followed in the large majority of cases. Such was the awful situation in the treatment of benign bladder tumors.

For malignant tumors of the bladder the literature apparently contained only four cases in which resection of the bladder had

been done. Recurrence or death had followed in all cases. The treatment usually employed was drainage, either perineal or suprapubic. A remarkable case is reported by Watson in which Pawlik extirpated the entire bladder and transplanted the ureters into the vagina, the external orifice of which was closed.

Arthur T. Cabot's chapter on "Stone in the Bladder, Prostate, Urethra and Ureters" occupies 130 pages. It is profusely illustrated and is a classic. His discussion of stone-crushing and Bigelow's method of litholapaxy is probably the most important contribution to the subject that has ever been made. Lithotomy is one of the oldest operations in surgical history. Both perineal and suprapubic methods for extracting stones have been employed for centuries. Cabot's description is encyclopedic.

For prostatic calculi, Cabot devised a median perineal operation. In regard to stone in the ureter, Cabot says if it is lodged in the abdominal portion of the ureter it may be reached by Israel's incision. In one case in which an incision had been made into the peritoneal cavity for the purpose of diagnosis where a stone had been found in the pelvic part of the ureter, it was found possible with a hand in the abdomen to lift the stone toward the crest of the ilium where it could be reached by an extraperitoneal incision. For the pelvic portion of the ureter stones were considered beyond operative relief except in the female, in whom the incision was made through the vagina.

"Surgical Diseases of the Kidney" was by Lewis A. Stimson, a celebrated surgeon. For wounds and injuries of the kidney Stimson said: "In some cases nephrectomy either as a primary or secondary operation has been done." For nephrolithiasis, Stimson's advice reads almost like a modern treatise: "The presence of stone having been determined, it should be removed either alone or with the kidney. The choice depends partly on the condition of the kidney, whether it is capable of sufficient functional activity to make its retention desirable, and if an existing abscess can be satisfactorily drained and partly upon the possiblity of making a complete and safe removal of the stone or stones. As a general rule, the kidney should be left if there is reason to believe that any considerable portion of it can do its work. . . . If any stone is left behind, a secondary operation will certainly be required. In cutting for a stone, it is better to make the incision through the parenchyma than through the wall of the pelvis; the bleeding is not severe and the probability of establishment of a urinary fistula is much less." In this statement the treatment of 1890 is at marked variance with that of today. Stimson's advice in tubercuolsis is still sound. "In tuberculous disease fairyl limited to the kidney, nephrectomy finds a special indication, the removal of a focus of disease in which a general infection may originate. König thinks the operation is clearly called for."

The urologists of the 1880's had already made numerous studies on hydronephrosis. The conclusions reached by Stimson are still acceptable: "This tube may be imperforate, or obstructed by an anomalous branch of the renal artery or folded upon itself from above downward, or obstructed by valvular folds of its mucous membrane or by cysts in its wall, or may have a minute vesical orifice or a very oblique communication with the pelvis." Nephropexy is recognized as an appropriate operation when nephroptosis is the cause of hydronephrosis with symptoms. The technic usually employed was drainage. No reference to corrective procedures at the ureteropelvic juncture are mentioned.

Cysts of the kidney usually were treated by incision, often through the peritoneal cavity, through which the diagnosis was usually made, but Tuffier had just reported the successful extirpation of a cyst and reunion of the kidney parenchyma by suture.

Morris was the most prolific writer on kidney diseases and presented an extensive discussion of the subject of tumors of the kidney.

In regard to the operative treatment, Stimson said the record which comprises more than 100 cases of nephrectomy was not encouraging, and he preferred the extraperitoneal method.

John P. Bryson devotes about forty pages to the subject of urogenital tuberculosis. He says that surgical measures should be held as a last resort, that castration is rarely necessary and that incision, curettage and drainage are the methods of choice. It is rarely advisable to remove a testicle.

Another 100 pages are devoted to minor genito-urinary problems which lack of space forbids discussing.

Such, then, was the situation in urology fifty years ago. Our predecessors had already done splendid experimental and clinical work and shown commendable surgical enterprise. Many of the most difficult operative procedures had already been attempted and some brought to a fair state of perfection. An excellent field had been prepared for the progress which was to be made in the next fifty years.

THE CYSTOSCOPE

We have already referred to the pioneer work of Nitze in the invention and development of the cystoscope and the application of the Edison lamp to his instruments, as well as the instruments of Brenner and Boisseau du Rocher, with which the ureter was catheterized in the female, in a few instances. But all efforts to catheterize the ureter in the male failed. James Brown (1893), by modifying Brenner's instrument so as to employ a curved stilet which facilitated the introduction of the catheter, was the first to catheterize the ureters in the male. A little later, Halsted was the first to carry out nephrectomy as a result of the diagnosis of pyonephrosis, following ureteral catheterization by Brown. Also in 1893, Kelly brought out his cystoscopic endoscope and introduced the principle of distention of the bladder with air by placing the patient in a position to obtain negative pressure. Casper (1895) devised the first apparently successful catheterizing cystoscope with right-angle vision. In 1897, Albarran designed his elevator which could be operated by an external screw so as to elevate the catheter and direct it into the ureter. After that, various modifications were made; worthy of mention are the photographic cystoscope and various operative cystoscopes of Nitze. In 1900, Reinhold Wappler, of New York, made for William K. Otis the first American cystoscope. About the same time F. Tilden Brown presented the first double catheterizing cystoscope; this was the direct type of cystoscope. Subsequently he introduced an indirect double catheterizing cystoscope of the Wappler type. Bransford Lewis (1903–1904) simultaneously did much pioneer work which led to various types of cystoscopes and cystoscopic apparatus. McCarthy (1923) presented a new type of telescope which looked almost directly forward, which he called the foroblique system. This was a very important addition and made possible the construction of many other instruments by Wappler for various designers, both urologists and specialists in other branches of medicine. As a matter of fact, the instruments used for cystoscopic work by urologists have had tremendous influence on the development of urology and many other fields of medicine. Leo Buerger played a large part in the modification and development of modern cystoscopes. Young, in a paper entitled "A Critique of Modern Cystoscopes," (1927) presented various new features that had wide usage. He and Butterfield presented small instruments for cystoscopy and ureteral catheterization in children. Various instruments for endovesical manipulation have been presented by Ravich, Lowsley, Young, Buerger and McCarthy.

Instruments of the endoscopic type, first introduced by Simon, Pawlik and other European designers and modified by Kelly in America and made practical by him for ureteral catheterization, have led to the

design and manufacture of various instruments, among which may be mentioned those of Braasch, Greenberg, Buerger and McCarthy. Urethroscopy was firmly established before 1890. The Electro-Surgical Instrument Co., under Mr. Maijgren, has been responsible for various types of urethroscopes, cystoscopes and resectoscopes.

THE X-RAY IN UROLOGY

Very soon after Roentgen published the discovery of the penetrating properties of radiations from Crookes' tube, to which he gave the name *x*-rays, the method was applied in urology. In 1896, Chapius and Chauvel reported the detection of renal calculi by means of the *x*-ray. In the follow-year Fenwick described the use of fluoroscopy at the operating table to locate renal calculi. In the same year, Tuffier tried to visualize the urinary tract by opaque metal ureteral catheters. Klose (1904) suggested the use of bismuth to outline the pelvis and ureter, as had already been done in the intestinal tract. Voelcker and von Lichtenberg (1906) reported the use of colloidal silver as an injection of the ureter and pelvis for radiography. To avoid the fatal cases which sometimes occurred with collargol, J. E. Burns (1915) investigated various other chemical compounds and proposed thorium nitrate as a satisfactory agent free from danger. Cameron, who had been working with Burns, introduced potassium and sodium iodide in 1918. In 1916, H. E. Potter presented the Potter-Buckey diaphragm which made possible much more satisfactory radiograms of the urinary tract. W. F. Manges described fluoroscopic study of the pelvis and ureter by pyeloscopy, in 1918. Others advocated serial urograms, and Jarre and Cummings presented "Cinex Camera Studies on the Urinary Tract" (1930) as a means of recording the motor function of the kidney pelvis, ureter and bladder. In 1919, Braasch and Carman advocated the use of the fluoroscope at the operating table to localize renal calculi and prevent leaving any behind. Waters and Young (1920) obtained radiographs of the seminal vesicles and vasa after the injection of an opaque solution through the ejaculatory ducts. In 1921, Young devised a combined *x*-ray and cystoscopic table. Also in 1921, came Carelli and Sordella with independent reports on the use of perirenal insufflation of oxygen to outline the kidney and adrenal gland. In 1923, W. C. Quinby proposed making radiographs of the exposed kidney at the operating table for detecting elusive renal calculi. Lipiodol, which has been extensively used in urology, was introduced by Sicard and Forestier in 1922. Rowntree, Osborne, Sutherland and Scholl (1923) showed that after oral and intravenous administration of sodium iodide, roentgenograms of the urinary tract might be obtained. In 1924, Volkmann reported experiments with lithium iodide, bromide and sodium iodide, and advised the latter drug for urograms. During the same year Rosenstein and others used sodium iodide. In 1929, Dos Santos, Lamas and Caldas further developed the work on arteriography and applied it to a study of conditions in the upper urinary tract by injections made directly into the abdominal aorta. Finally, Swick and von Lichtenberg developed uroselectan, with which very satisfactory intravenous urograms were obtained. Since then, other drugs have been presented for urography.

Thus have the *x*-ray and the cystoscope, in conjunction with phenolsulfonphthalein, furnished the urologist with diagnostic methods superior to any which may be found in any other specialty.

TESTS OF RENAL FUNCTION

The last fifty years marks the development of a method to determine renal function, culminating in the phenolsulfonphthalein test, the most satisfactory for urological cases. Previously patients with diseased, inefficient kidneys were unwittingly subjected to operation with disastrous results. In 1892, Dreser applied the principle of Raoult and Van't Hoff which showed that the osmotic pressure is propor-

tional to certain other properties, including the freezing point. Thus, by freezing point determinations it was possible to determine the solids present in a specimen of urine. This is known as cryoscopy. F. von Korànyi (1897–1898), a Hungarian, and Hamburger (1907) also reported the use of this test.

The first dye test used was that of fuchsin, reported by Bouchard (1877). But within the past fifty years a more important contribution was made by Achard, and Castaigne (1897) described the secretion of methylene blue by the kidneys and used it as a renal function test.

Rosaniline (rosaniline trisulfate of sodium) was introduced by Lepine (1898), and indigo carmine by Voelcker and Joseph in 1903. The objection to all of these dyes was their slowness of excretion and, in the case of some, their only partial excretion by the kidney.

A different phenomenon was used in the test with phloridzin, a sugar which Von Mehring had described in 1885 as producing glycosuria without hyperglycemia. It remained for Klemperer (1895) to use it as a function test after observing that the glycosuria failed to appear in the presence of nephritis. In 1903, Casper and Richter published a book on Functional Diagnosis of Kidney Disease with Special Reference to Renal Surgery.

In 1884, Ira Remsen, professor of chemistry at the Johns Hopkins University, described a red dye-stuff, which he gave the name phenolsulfonephthalein. Nothing further was done with this drug until J. J. Abel tested its physiological properties and showed that over 95 per cent of the drug was eliminated through the kidneys with remarkable rapidity. The drug was again put aside as being of no particular value until 1909 when Abel and Rowntree attempted to see whether phenolsulfonphthalein would be excreted differently in a case in which unilateral nephritis had been produced experimentally in a dog. The dog experiments led to erroneous deductions, but by applying the tests to patients in the hospital Rowntree and Geraghty (1910) showed that phenolsulfonphthalein was a very sensitive and accurate test of renal function.

Shaw (1925) studied the excretion at more frequent intervals and enhanced the value of the test. Young presented a phthaleinometer in 1930 (with Elvers) and, in 1931, a chart to record thirty-minute readings.

Another great advance in studying renal function came from determinations of the urea content of the blood and urine. In 1904, Grehant reported comparative studies of urea in the blood and urine. The method of Folin for the determination of non-protein-nitrogen was reported in 1905. In 1910, Ambard's constant was introduced. It was supposed to represent the ratio of the concentration of urea in the blood to the square root of the urea output of the urine in twenty-four hours. Later experiments by Addis and Drury, and also by Van Slyke have discredited the "constant d'Ambard."

The urea clearance test of Van Slyke was reported in 1929.

The present Mosenthal dilution-concentration test was antedated by the work of Hedinger and Schleyer in 1914.

Of the various tests used during the past fifty years to determine renal function, the two most important are the phenolsulfonphthalein and the urea content of the blood which the method of Hench and Aldrich (1926) has greatly simplified. The phenolsulfonphthalein test detects renal damage secondary to obstruction much earlier than the determination of the non-protein-nitrogen or urea. But the latter tests are very important especially when contrasted with the phenolsulfonphthalein determinations. Indigo carmine is much less accurate but still valuable, particularly in chromocystoscopy where ureter catheterization is difficult.

NEUROGENIC DISORDERS

The mechanism of micturition has been studied intensively during the last twenty-five years. In 1918, Young published his

observations that contraction of the trigone opened the vesical orifice and initiated micturition. Wesson (1920) made an exhaustive study of the development of the trigone and neck of the bladder, and by means of serial sections demonstrated the arrangement of the musculature. The following year Young and Wesson watched the action of the trigone by endoscopy. In 1923, Macht studied the effect of drugs on the trigone and detrusor; he showed that the trigone was innervated by the sympathetic system and that detrusor action was lessened by adrenalin. Langworthy and his co-workers carried out a long series of experiments on animals, publishing a series of articles on the central nervous system's control of micturition. In 1940, Langworthy, Kolb and Lewis published an extensive monograph on the physiology of micturition, emphasizing control of the bladder by reflex arcs throughout the entire nervous system.

Prior to the introduction of efficient chemotherapy in the management of urinary tract infections, many patients with injury to the spinal cord died as the result of ascending urinary tract infection introduced by catheterization. Fully 80 per cent of soldiers with such injuries died. Sir John Thomson-Walker advocated suprapubic cystostomy. Murphy and Kanavel showed that these bladders would finally overflow and not rupture. Orders were therefore issued by the urological staff of the American Expeditionary Force to refrain from any introduction of instruments into the urinary tract. Nothing further was added to the treatment of acute traumatic lesions until Munro and Hahn (1935) recommended tidal drainage of the bladder in the control of infection. The avoidance of overdistention with consequent damage to the vesical musculature is now considered of paramount importance.

Great progress in the diagnosis of neurological lesions affecting the bladder has been made through clinical cystometry. Intravesical pressure had previously been measured, but Schwarz in 1917, and Adler in 1918, described determinations of pressure under known volumes. By this method they studied the cerebral control of micturition. Impetus was given to the study of neurogenic disorders by Rose (1927), who described the effect of lesions of the spinal cord on vesical activity. He constructed the first clinical recording cystometer. Learmonth (1931) published a series of articles demonstrating the influence upon the bladder of the presacral nerve. He recommended resection of this nerve to insure more efficient emptying of the bladder in certain cases of vesical dysfunction, and in other instances to relieve vesical pain. Quinby, in the same year, showed beneficial results by resecting the presacral nerve in patients with painful bladders caused by interstitial cystitis. Muschat and Johnson, (1932) by means of a simplified mercury manometer, described the types of activity of atonic and hypertonic bladders. Watkins (1934) showed the value of bladder pressure determinations in disturbances of innervation. His description of five cases of spinal cord injury is noteworthy. Dees and Langworthy, in 1935, produced tabetic bladders in cats by bilateral section of the second, third and fourth dorsal sacral roots. They showed that although these cats were incontinent, their bladder function was restored to normal limits by division of the presacral nerve. In the same year, Lewis, Langworthy and Dees, using a water cystometer, described vesical activity in lesions of the motor nerves. Langworthy, Lewis, Dees and Hesser (1936) published a clinical study of the control of the bladder by reflex arcs through the central nervous system. They demonstrated reflex activity of the bladder in normal persons and in patients with known neurological disease, by kymographic records. In 1936, Simons developed a cystometer with attachments for determining the resistance of the musculature of the vesical orifice and external sphincter. Lewis (1939) presented his recording aneroid cystometer which has simplified the making of permanent records. During the same year, Landes brought out

another very sensitive aneroid cystometer. A monograph on neurologic bladder disturbance was published by Frederick C. McLellan in 1939, emphasizing the value of cystometry. Numerous other instruments have been brought out by Lowsley, Landes, Weyrauch and others for the study of intravesical pressures.

ANESTHESIA

Local anesthesia had already been introduced and used on mucous membranes previous to 1890. However, its use was greatly stimulated by a book written by Heinrich Braun in 1905, entitled "Die Lokalanästhesie." An advance was made when Bransford Lewis, about 1900, (1924) advocated an anesthetic tablet to localize the area of anesthesia more sharply.

August Bier was the first to produce spinal anesthesia by the injection of cocaine into the spinal canal in 1899. One year later Tuffier reported many operations on the genito-urinary tract under spinal anesthesia. The next year, 1901, Goodfellow, in San Francisco, used spinal anesthesia with cocaine for perineal prostatectomy. Little progress was made until cocaine was replaced by less toxic drugs. Tropacocaine and stovaine were generally used. The undesirable reactions were greatly decreased with the introduction of procaine (novocaine) in 1904 by Einhorn. In 1910, S. P. Delaup was able to report its use in 585 genito-urinary cases. In 1912, Gray and Parsons studied the variations in blood pressure associated with lumbar puncture and the induction of spinal anesthesia. Smith and Porter (1915) stressed preventing diffusion of the anesthetic solution into the thoracic portion of the spinal canal. In 1927, Rudolf and Graham advocated the use of ephedrin to prevent depression of the blood pressure. In 1928, Keyes recommended spinal anesthesia for all operations on the bladder and said that he had found ephedrine very effective in preventing the fall in blood pressure. During the past ten years many drugs have been used, but pontocain seems most popular at present. Injection is usually made between the third and fourth lumbar spines; but for operations on the kidney, the injection is usually made between the second and third lumbar vertebrae and more spinal fluid is withdrawn in making the solution. In many urological clinics spinal anesthesia is considered the method of choice, with a few exceptions, notably children.

Paravertebral anesthesia was originated by Sellheim (1905) and first used in urologic surgery by Kappis (1912). Parasacral anesthesia was originated by Heinrich Braun (1914). Caudal block anesthesia was first successfully used in patients by Stoeckel (1909). Cathelin, before 1900, had used epidural injections of salt solution in the treatment of eneuresis and later used cocaine, obtaining anesthesia similar to that of intrathecal spinal anesthesia. Transsacral anesthesia was first carried out by Danis (1914). Edwin Davis has in recent years been a consistent advocate of caudal and sacral block for perineal operations.

In 1911, Kretschmer presented the first paper on ethylene anesthesia in genito-urinary surgery.

Intravenous anesthesia, which was first used in 1872 by Oré, (1873), had fallen into disuse until 1899 when Dreser produced general anesthesia by an intravenous injection of hedonal. Krakow produced a narcosis with a combination of hedonal and chloroform given intravenously, in 1908. Burkhardt (1909) used an injection of ether and chloroform. Other compounds which were injected include paraldehyde, trichlorisopropyl alcohol, magnesium sulfate, ethyl alcohol and avertin, but the use of all these was transitory. Sodium amytal was first used intravenously to induce anesthesia by Zerfas (1929). The use of evipal was reported by Kropp and Taub (1932). Lundy published in 1935 the first report on the use of pentothal sodium, the compound now in vogue.

INFECTIONS

Bacteriology. By 1890, most of the bacteria of importance in genito-urinary

infections had been isolated. Among these were the gonococcus, by Neisser (1879), the tubercle bacillus by Koch (1882), B. pyocyaneus by Gessard (1883), staphylococci and streptococci by Rosenbach (1884), Proteus by Hauser (1885), Colon bacilli by Escherich (1885) with the recognition of their two main types, chemically differentiated by later work into the genera now called Escherichia and Aerobacter; and Ducrey's bacillus (1889).

Since 1890, bacteriological investigations have been much more concerned with refinements within the different groups of organisms, with a steadily increasing emphasis on their antigenic constitution, as in the grouping of the streptococci; with improvement of methods for the isolation of bacteria; and with a growing knowledge of the great difference that apparently slight variations in antigenic structure may make in resistance to chemotherapy.

Specifically, the following examples are outstanding:

1. The Gonococcus: The great advance has been improvement of culture methods, now of extreme importance in view of the rapidity with which the organisms become microscopically invisible after sulfonamide therapy. This advance depends upon three steps: (1) The use of improved media, *e.g.*, the "chocolate blood agar" of McLeod (1934), and testicular agar of Anne C. Pitts (1940); (2) the incubation of the cultures in 10 per cent carbon dioxide; and (3) the use of the oxidase test for the detection of gonococcus colonies (Gordan and McLeod, 1928).

2. The Streptococci: The outstanding advances have been

a. Classification accurately on the basis of hemolysis, J. H. Brown (1919).

b. Classification on basis of antigenic structure, now superseding the former and based on the work of Lancefield (1933).

c. Recognition that slight changes in such antigenic structure may make a great difference in resistance to chemotherapeutic agents, as in the resistance of Group D hemolytic streptococci and related forms to sulfanilamide and similar therapy.

3. The Colon Group: Recognition of the necessity for accurate identification of these organisms in genito-urinary infection (Hill, Seidman, Stadnichenko and Ellis, 1929) and of the differences of resistance of these organisms to chemical attack (Colston and Hill, 1932) has become increasingly important.

4. Proteus: The significance of the ureolytic action of this organism, especially in relation to encrusted cystitides (Hager and Magath, 1925) and to recurrent lithiasis is now fully recognized (Smith, G. G., 1939).

At present interest in the enzyme activities of bacteria, such as their ability to split urea (Hill and White, in press) and the action of chemicals upon such enzymes are the vital problems upon which research in genito-urinary bacteriology is centered.

In regard to the more general problem of genito-urinary infection, much remains to be learned. We have as yet few methods for studying the differences of tissue responses and of the resistance of bacteria in the tissues. We have little knowledge of the exact mechanism of chemotherapy in the body. The complexity of these subjects commands correlated researches in many different fields.

Urinary Antiseptics. For many years it has been known that certain drugs were eliminated largely by the urinary tract. Uva ursi, turpentine, copaiba and other similar drugs have been employed for generations, almost to the exclusion of other drugs, in the treatment of gonorrhea and other urinary infections. In 1894, Nicolaier brought out methenamine, or Urotropin. He asserted that when given by mouth it was eliminated by the kidneys and was often effective in combating urinary infections. Five years later he showed its good effect was due to the liberation of formaldehyde. Burnam (1912) found that the liberation of formaldehyde by different individuals varied greatly. Hinman (1913) showed that unless given in huge quantities

formaldehyde had very indefinite action against bacteria and was more effective in the bladder than in the kidney. Other experimental work on these drugs was published by Shohl and Deming (1920), Thomas and Wang (1929), Vermooten and Berry (1933) and others.

In 1914, Abelin found that after intravenous injections of neosalvarsan formaldehyde appeared in the urine. This was not true with salvarsan. Porges (1916) reported a case of tabes with infected urine which cleared up on neosalvarsan injections. Gross (1917) confirmed the efficacy of neosalvarsan in gonorrheal cystitis, but reported no effect on B. coli infections. During the World War Levy-Bing found that in cases of syphilis complicated by gonorrheal epididymitis, intravenous injections of neosalvarsan resulted in rapid improvement of the epididymal infection. After returning from France, Young began to use intravenous injections of neoarsphenamine in various types of coccic infection of the urinary tract. Of thirty-nine upper tract infections, ten were sterilized, thirteen improved and sixteen were failures. After chemical study White asserted that it was difficult to explain the action of the drug, as not enough formaldehyde was eliminated to make antiseptic urine. The work of Ramon, who in 1923 described a detoxifying action of formaldehyde, suggests another possible mode of action of neoarsphenamine. In 1918, Davis advocated acriflavine for gonorrhea. He also claimed results intravenously.

In 1924, Young and Hill presented cases of urinary infection which had been treated the previous year by the intravenous injection of 1 per cent mercurochrome. The first case was one of bilateral pyelonephritis in which following ureteral catheterization the patient had septicemia. When desperately ill he was given 34 cc. of a 1 per cent solution of mercurochrome intravenously by Dr. J. A. C. Colston. This was followed by a rapid disappearance of the fever, and sterilization of the blood and also the urine, both of which were heavily infected with B. coli. In the same paper a case of urinary infection treated by gentian violet was reported. Hill and Colston (1923) demonstrated bacteriostatic action of urine after intravenous injections of mercurochrome into rabbits. Young and Birkhaug (1924) reported a case of scarlet fever complicated by streptococcus infection of the urinary tract. This desperate case was quickly cured by an intravenous injection of mercurochrome. In 1925, Young, Scott and Hill presented an exhaustive collection of cases treated by intravenous mercurochrome. These reports came from numerous authors and demonstrated the great value of mercurochrome when introduced intravenously in many different types of infections, local and general. This report included twenty-three cases of pyelonephritis, four cases of cystitis and prostatitis, thirty-seven cases of gonococcic infection, among which were twelve cases of gonorrheal arthritis, many of which were shown to be amazingly improved by intravenous injections of 1 per cent of mercurochrome. The use of the drug was shown to be comparatively free from serious danger, although troublesome complications, especially nausea, vomiting, diarrhea, stomatitis and high fever occasionally occurred. Confirmation of the value of intravenous mercurochrome was obtained from many writers, among whom may be mentioned several from the Mayo Clinic, particularly those papers on the use of the method in pyelonephritis by Braasch (1926) and recent papers by Emmett and by Livermore.

Although an impartial review of the large number of reports on the intravenous administration of mercurochrome justified the conclusion that excellent results were sometimes obtained in general and local infections, still the fact that it had to be given intravenously and was frequently followed by uncomfortable reactions and could not be successfully employed by mouth, markedly interfered with its general adoption. When sulfanilamide, a drug that

could be given in larger quantities by mouth, appeared, the stage was set for its adoption by the medical profession.

Sulfanilamide was made by Gelmo in 1908. The complex history of these compounds is clearly stated by Justina Hill in her book, "Germs and the Man." Long and Bliss were the first to present experiments with sulfanilamide in this country. Very promptly, studies on the effect of the drug in genito-urinary infections were reported by Helmholz (1937). Vest, Young, Herrold and others reported cases of genito-urinary infections in human beings. In the spring of 1937, Reuter of Washington, and Dees and Colston of Baltimore simultaneously began treating cases of gonorrhea with sulfanilamide. Their reports of remarkable results in the disappearance of the urethral discharge and the gonococcal infection startled the urological profession, and the use of the drug in gonorrhea soon became widespread. In the past three years innumerable articles have appeared that attest to the great value of this new form of therapy. Culp, in a critical analysis of cases of gonorrheal arthritis treated by intravenous mercurochrome and sulfanilamide by mouth, showed practically equally great efficacy of the two methods. Mercurochrome was a little more rapid in its effects.

With the introduction of sulfapyridine, better results were obtained in the treatment of staphylococcic infections. It was soon found that this drug was also effective in many cases of gonorrhea (Michon, 1939; Herrold, 1939) and of bacillary urinary infections. Sulfathiazole, possessing the most powerful direct antibacterial action of any of these three drugs has, within a year, established itself as a compound of great value in the treatment of urinary infections. Helmholz (1940) reported that sulfathiazole and sulfamethylthiazole kill both Streptococcus fecalis and Staphylococcus aureus in lower concentration in the urine than the Gram-negative bacilli. The failure of these drugs to protect against or sterilize urinary infections due to Group D streptococci, especially gamma Streptococcus fecalis and Pseudomonas pyocyanea remains their great weakness as urinary disinfectants. The possibility of surgical prophylaxis against wound infection with sulfathiazole has recently been shown (Young, Hill and Semans). The action of sulfanilyl guanidine either directly or indirectly in urinary infections remains to be shown. Other modifications of these drugs have been put on the market and are being tested in laboratories and clinics. It is evident that in the near future more specific and more efficient drugs will be on hand to combat the various types of genito-urinary infections, but already tremendous strides have been made, and in no other field of medicine has the use of chemotherapy proved more remarkable than in urology.

In 1917, Shohl and Janney reported that B. coli were inhibited from growing in urine with a pH between 4.6 and 5.0 and between 9.2 and 9.6. This demonstration of the inhibitive effect of marked acidity and also marked alkalinity has had a pronounced effect on subsequent investigations of urinary antiseptics. Clark (1931) observed that urine containing ketone bodies was bacteriostatic. He and Helmholz at the same time reported a series of cases of adults and children in which they had successfully treated bacillary infections by placing the patients on a ketogenic diet. Fuller (1933) showed that beta-hydroxybutyric acid was the active bactericidal substance in the urine of patients on a ketogenic diet. Crance and Maloney (1935) announced that the oral administration of nitrohydrochloric acid resulted in the reduction of the pH of urine to 5.3 or less, and in a shorter time than with the ketogenic diet. He reported a series of favorable cases. Rosenheim (1935) announced that mandelic acid is closely allied to beta-hydroxybutyric acid and that when given by mouth it is excreted unchanged in the urine and possesses the same bactericidal properties as beta-hydroxybutyric acid without its toxicity. A month later, Cook and Braasch reported local instillations into the bladder of solutions of beta-hydroxy-

butyric acid which served in some cases to sterilize bacillary infection of the bladder. Yeaw (1940) has re-studied the effect of acidity on bacteria in the urine and has shown that while, clinically, bactericidal levels could be reached only for the streptococci, a bacteriostatic level could be reached which would inhibit the growth of all organisms except B. coli.

UROLITHIASIS

Since time immemorial it has been known that urinary calculi occur in certain geographic districts with far greater frequency than in others. In India, stone is very common among the natives who live in the upland districts away from the seashore. The assumption was drawn many years ago that the difference in diet between these two classes of natives played an important role in the development of calculi. But it was not until recently that the subject has been studied scientifically and real progress made.

Etiology. Bartlett (1895) asserted that infection played an important part in the development of nephrolithiasis and classified the routes of infection as (1) descending infection from the circulation in septicemic conditions; (2) ascending infection from a focus lower in the urinary tract; and (3) transmission from neighboring organs by contiguity. Guiteras (1906) stated that calculi are precipitated from urine as a result of decomposition due to some local infection or inflammation. Kretschmer (1916) studied cystine calculus and discovered the presence of cystine crystals in the urine. Osborne, Mendel and Ferry (1917) observed that calculi, both renal and vesical, could be produced in white rats which were maintained on a diet deficient in vitamin A.

Linwood Keyser has played an important part in the explanation of the etiology of urinary calculi in a series of papers. His first paper (1922) was published in conjunction with William F. Braasch. In a clinical study they concluded that some local mechanism was at work in the renal pelvis or bladder which caused the formation of calculus. They also considered the possibility of a specific stone-forming infection as an etiologic agent. They felt that excessive excretion of crystalloid material may reach such a degree that the protective colloids in the urine could not handle the extra burden.

Rosenow and Meisser (1923) reported experiments in which a focus of infection present in the teeth of animals, produced by the insertion of streptococci, obtained from urine of patients with urinary calculi, caused similar calculi to appear in the kidneys of the animals.

The foregoing observations led to a great deal of work on the development of calculi and their prevention by the removal of points of obstruction, provision of free drainage, correction of diet, and the elimination of focal and local infections. Prominent among these was a paper by Guy Hunner (1924) who emphasized the importance of ureteral stricture in the formation of renal calculi.

In 1933, Charles C. Higgins reported the results obtained in white rats which had been kept on a diet deficient in vitamin A for 200 days. It was discovered that in 88 per cent of the animals vesical calculi had developed; at the end of 250 days, renal calculi had developed in 41 per cent. H. C. Hou (1936) and others observed that by the addition of vitamin D to the diet which was poor in vitamin A, the percentage of animals in which calculi developed was increased.

In January, 1934, Albright, Baird, Cope and Bloomberg demonstrated the types of renal complication which may be associated with hyperparathyroidism. They reviewed eighty-three cases of hyperparathyroidism. In forty-three, there was a renal complication; twenty-three showed precipitation in the renal pelvis, with pyelonephritis; in nineteen, there was precipitation in the renal tubules with resulting renal sclerosis; and in one, there were calcium deposits in the form of fine granules in the kidney as well as in many other organs.

In April, 1934, Albright, Aub and Bauer published the results of a comprehensive study of seventeen cases at the Massachusetts General Hospital in which a parathyroid tumor had been removed. In one case a plain roentgenogram of the abdomen revealed in the region of each kidney stellate groups of punctate shadows outlining the renal pyramids, leading to the proper diagnosis.

In May, 1934, Albright and Bloomberg cited eleven cases from a series of twenty-three proven cases of hyperparathyroidism at the Massachusetts General Hospital where the presence of renal stones was the only clue which led to the diagnosis of the underlying disease. They stated that many finely granular casts containing calcium were often found in the urinary sediment. These casts could be made to change into hyaline casts by acidification of the urine. The authors considered them to be microscopic calculi from the renal tubules.

In September, 1934, Barney and Mintz reviewed a group of eighteen cases of hyperparathyroidism which had been proved by operation. In eleven (61.1 per cent) urinary calculi were present. They concluded that parathyroid disease was present in 10.5 per cent of their total series of 104 cases of urinary calculus.

Griffin, Osterberg and Braasch (1938) reported that in a study of a large number of cases of urinary lithiasis they had found hyperparathyroidism to be an etiologic factor in less than 0.2 per cent. Higgins concurred in the opinion that parathyroid disease was a rare concomitant. Nevertheless, it is accepted now that *x*-ray studies of the bones and determination of the amount of calcium in the urine should be made when there is an elevation of the serum calcium and a lowering of the serum phosphates.

Flocks (1939) reported his results of a study of thirty-five patients with calcium urolithiasis. In 66 per cent an abnormally high calcium excretion was found in an analysis of the urine. In the great majority of these, there was no evidence of bone disease, hyperparathyroidism, change in the blood calcium or phosphorus or other demonstrable abnormality of calcium metabolism. In cases of this sort he recommended prophylactic measures to prevent recurrence, consisting of a low calcium intake, acidification of the urine, and vitamin A without admixture of vitamin D.

In 1912 and again in 1913, Caulk reported cases of primary necrosis of the papilla with deposition of calcium phosphate. The possible relation between this and renal calculus was not mentioned. In 1936, Alexander Randall expressed his opinion that the development of a primary stone in the kidney follows a lesion in the papilla. He found in kidneys removed at autopsy subepithelial and extratubular deposits of calcium in the papilla. He concluded that such a calcium plaque subsequently loses its epithelial covering. Urinary salts are then deposited from the circumambient urine. He stressed the fact that this process occurs in the absence of urinary tract infection and obstruction. A full exposition of this subject has been made in his recent paper (1940).

Diagnosis. Before 1895, Howard A. Kelly introduced bougies and catheters coated with wax bulbs and thus diagnosed by scratch marks the presence of calculi in the upper urinary passages. By the use of wax bulbs placed at intervals along the course of the bougie, Kelly was able to determine with fair accuracy the exact location of the calculus in the ureter. In 1895, Roentgen announced the discovery of his *x*-ray; the following year McIntyre of England demonstrated positive films for stones in five cases of renal calculi in which the stones were subsequently removed at operation. In 1899, Abbe collected from the literature over twenty cases in which a diagnosis of stones had been made by *x*-rays. Kelly and others further aided in the diagnosis by introducing shadowgraphic catheters. The successful cystoscopic catheterization of the male and female ureter by Brown in 1893 and by Kelly in the same year added much in-

formation to the condition of the kidneys in cases of nephrolithiasis.

The introduction of pyelography by Voelcker and von Lichtenberg (1906) added another important diagnostic measure.

When the phthalein test was introduced by Rowntree and Geraghty (1910) information of much value became available. The capstone was added when von Lichtenberg (1929) announced the perfection of intravenous urography by means of uroselectan.

In the meantime, the *x*-ray, which at first required exposures of over thirty minutes to depict calculi, became more and more rapid and efficient, and with the development of stereoradiography combined with other scientific measures, above outlined, furnished precise information of great value in the diagnosis and treatment of urinary calculi. Braasch's classic book on pyelography (1915) was of inestimable value in systematizing the knowledge of the subject.

Surgical Treatment of Renal Calculus. By 1890, the surgical treatment of renal calculus had already made great advances. The oblique muscle-cutting extraperitoneal technic was usually employed, Israel extending the incision downward to expose more and more of the ureter. For ten years stones had been removed through the kidney or pelvis, and many papers describing different methods had appeared. Since then the literature on this subject has been vast. Many of the papers, while presenting much interesting information and statistical data have very little that is entirely new on the subject. In this vast bibliography it is impossible to do justice to even the most important contributions. It was soon realized that operations through the renal cortex were often accompanied by severe hemorrhage, and the trend to pyelotomy had already begun.

In 1898, Robson presented a paper on the method of exposing and operating upon the kidney without division of the muscles, vessels or nerves. Kelly also wrote on the same subject. In 1912, W. J. Mayo also presented a special incision for lumbar exposure of the kidney.

In 1901, Broedel, after interesting work on animals and in autopsies, described a zone in the kidney which was relatively free from blood vessels. He showed that the kidney was supplied by an anterior and a posterior group of arteries which did not anastomose. This zone lies immediately beneath a line which was parallel and slightly posterior to the lateral convex border of the kidney. In order to bisect the kidney along Broedel's line, Cullen and Derge (1909) introduced a silver wire with a long straight or curved blunt needle. The wire was drawn back and forth along Broedel's line, which had been marked out with a scalpel on the outer border of the kidney. In this way the kidney was bisected along the supposedly rather avascular zone. Many observers, however, did not find that the operation had been rendered much less bloody by this technic; in recent years operators usually have preferred to go more or less directly down upon the known location of the calculi. Kelly advised that when the incision was made to reach a calculus, it should be, if possible, perpendicular to the hilus and thereby avoid dividing transversely the blood vessels as they travel outward from hilum to cortex.

When extensive incisions were required in the kidney cortex, hemorrhage presented a great problem. In was soon found that the vessels of the pedicle could be clamped for only a short period without danger of seriously impairing the tissues of the renal cortex. In the closure of cortical incisions, mattress sutures usually bolstered by masses of fat (Mayo) or muscle tissue were generally employed by various operators. The great difficulty with the removal of stones by nephrotomy was the uncertainty in removing every last stone or fragment; this still is one of the great problems of renal surgery. The removal of stones through incisions in the pelvis or adjacent ureter soon was recognized as the better method of approach by almost all operators, but there was a divergence of opinion

as to whether the pelvic wounds should always be sutured or often left open. In 1913, Lower discussed conservative methods of operating upon the patient with stone in the kidney.

Fenwick (1897) suggested and used the fluoroscope at the operating table to rule out urolithiasis and to establish the diagnosis in doubtful cases.

In 1917, J. Edward Burns presented a new method for locating small calculi deep in the kidney and at operation. His method was based on the use of stereoscopic *x*-ray films and accurately determining the point beneath which the stone lay and finding it by needling. Braasch and Carman (1919) made use of the fluoroscope at the operating table to localize renal calculi and particularly to determine whether all stones had been removed. Quinby (1925) presented a paper on the localization of renal calculi by *x*-ray films made during operation.

Lowsley and Bishop (1933), acting on the suggestion of William P. Didusch, introduced the use of broad strips of ribbon catgut to close extensive nephrotomy wounds. Ribbon gut has been used by Lowsley and others in many other operations.

An important paper was that of George Prather (1934) who presented a new operative technic for widely opening a kidney to facilitate the complete removal of a staghorn calculus. It consists of a v-shaped incision, the apex being at the pelvis and the branches extending out toward each pole. Through this incision Prather was able to remove large staghorn calculi and be sure that no fragments remained. Successful closure with sutures was carried out.

Counseller and Hoerner (1936) advised the introduction of a drainage tube through the cortex into the pelvis to aid in the rehabilitation of an extensively damaged kidney after removal of stones. On the other hand, Keyes recommended pyelotomy drainage for nephrotomy wounds in 1917.

One of the greatest problems in the surgery of renal calculi arises when both kidneys are the seat of stones. An early paper on the subject was that of Nicholich (1910). Braasch, Higgins, and Hinman have also contributed important articles on the subject. Hryntschak (1933) reported fifteen cases of bilateral stone, seven of which were operated upon in one stage without a postoperative death. Each case presents a problem that requires individual consideration.

Another serious question is, when is one justified in doing a nephrectomy for renal calculus? Numerous authors agree that many kidneys are so greatly injured that nephrectomy is the safest and surest method of curing the condition, but the danger of the development of stones in the opposite kidney has made various surgeons hesitate before carrying out nephrectomy.

With the advent of sulfanilamide and its derivatives, and the ability to sterilize the urinary tract after removal of calculi, the chance of preventing recurrence and the eventual development of a calculus on the opposite side is brighter. When renal calculi were present on both sides and recur after operation, one is often confronted with the problem of what to do to save the patient's life. In 1908, Francis Watson reported that he had established a permanent renal fistula in a case from which a calculus could not be removed. The procedure, which Watson called nephrotresis, was effective for the many years that the patient lived. Watson also described transplantation of the ureter to the loin for renal drainage—dermatoureterosis, he called it. Subsequently, he said that thirteen cases had been reported. Bovée mentions five cases in which the ureter was anastomosed with the urethra.

Cystoscopic Treatment of Ureteral Calculus. In 1901, Young detected a stone projecting from the left ureter and extracted it by means of a bougie passed through the cystoscope (published in 1902). Kelly and his associates popularized the dilatation of the ureters by large catheters and bougies to facilitate the passage of

calculi down the ureter. A little later Hall reported a case in which he had removed a calculus caught in the lower end of the ureter in a female by means of Kelly's cystoscope. Cystoscopic dilatation of the lower end of the ureter to make room for the escape of a calculus was successfully carried out by Kolisher, Casper and Kreissl.

"In 1904, Bransford Lewis amplified and modified endoureteral instruments of Kohlman, Oberlander and others, and presented his operative cystoscope for use in the bladder and lower ureter. This was the first formulated cystoscopic attack upon ureteral calculi and stricture and paved the way to cystoscopic ureteral surgery as it exists today." (Ernest G. Mark.)

Among those noted for extraction of many and large calculi by endoureteral means, A. J. Crowell (1921) deserves special mention. In 1926, Councill presented his stone extractor, a wire basket which could be expanded so as to entrap a calculus as it was drawn down the ureter. With this instrument Councill has been very successful in removing a great series of calculi, now almost 500. A somewhat similar instrument was invented by Franklin P. Johnson (1935). Other technics for the extraction of calculi, such as introduction of several small bougies or catheters, have been introduced from time to time. Among these writers may be mentioned McKay, and Alyea. Various drugs such as pantopon, novocain and avertin, the latter by Jarman and Scott (1937), have been introduced into the ureter to cause dilatation and facilitate the passage of calculi.

Surgical Treatment of Ureteral Calculus. By 1890, the extraperitoneal removal of ureteral calculi had already been carried out in several cases, either through an incision in which the kidney was exposed or through one lower down in which only the ureter was isolated. In some cases, in women, calculi were removed through an incision more or less parallel to the spines of the vertebrae without cutting the abdominal muscles. In 1935, Frederic E. B. Foley approached the upper ureter by an incision parallel to the last rib through which the ureter could be reached without cutting any muscles. At the apex of Petit's triangle the muscles were retracted, exposing the lumbodorsal fascia which Foley incised in the direction of its fibers and thus gained access to the ureter extraperitoneally.

Calculi in Pelvic Portion of Ureter. In 1898, Fenger in a classical work on the ureter said:

> There is no difficulty in gaining access to the upper three-fourths of the ureter by the oblique lumbar incision. It is different with the lower fourth of the ureter which is located deep down in the pelvis and is even held by Le Dentu to be inaccessible. But as Cabot has pointed out, this portion is also accessible without opening into the peritoneum by means of the sacral operation of Kraske.

But no one had used the Kraske incision, and in December, 1899, Henry Morris, after an exhaustive study of the literature, said that no case had been reported of ureterolithotomy for stone impacted in the lower end of the ureter in the male.

Helferich (1894) published a case in which after removing a vesical calculus suprapubically he discovered another stone projecting from the mouth of the ureter. The orifice was dilated and the calculus extracted. Pitts (1898) described one case, Bishop (1899) two cases and Newman (1900) also published two cases. In 1898, Fenwick removed a calculus from the lower end of the ureter through a transverse perineal incision in a male aged eighteen. He reached this stone retrovesically and extracted it through a longitudinal incision. It was about the size of a small peach stone. In 1887, Ceci found, on rectal examination, a large, hard mass in the region of the left ureter and after dilating the anus a bistoury was inserted and seven stones removed from the left ureter. The patient died thirty-six hours later.

In 1901, Morris reported two cases in females in which, through an incision five

inches long parallel to the sacral spines and two inches distant from the middle line, he had removed a stone from the ureter just above the bladder with the assistance of a sound in the bladder and a finger in the vagina. Both patients recovered. The upper extraperitoneal route was used by Twynam in 1890. The patient was a boy of eight years. Exploratory laparotomy was performed and a small ureteral stone found by the hand in the abdomen. It was lodged near the vesical end of the ureter. At a later date, through an oblique abdominal incision, the ureter was exposed extraperitoneally, the ureter brought up and incised and the stone removed. The wound was closed with silk sutures. The patient recovered. After this first case stones were successfully removed from the pelvic portion of the ureter by Morrison and Israel (in three cases) in Europe.

In 1902, Young reported the first cases in which stones had been removed from the lower end of the ureter in the United States, one by himself and one by Finney. Both patients recovered.

These early operations upon the lower end of the ureter were through a low oblique muscle-cutting incision. Later, through a similar incision, the gridiron principle was extraperitoneally employed, and the pelvic ureter reached without division of the abdominal muscles.

In 1910, Gibson reported that he had been using a long curved incision in the lower quadrant. The lower end of the incision was carried horizontally just above the pubis to the midline. The incision then extended laterally a little above Poupart's ligament to about the midpoint and then ascended vertically to end just medial to and a little above the anterior superior spine. The aponeurosis of the external oblique was incised in the direction of this incision, and the only muscle which was divided was the internal oblique. The transversus abdominis was split in the direction of its fibers. A vertical incision along the lateral border of the rectus sheath enabled the rectus muscle to be retracted medially and gave a wide exposure of the pelvis.

Removal of Ureteral Calculi through the Vagina. "Although Emmett (1884) was the first to describe the vaginal route for removal of ureteral calculi, there is apparently no record of the operation having been successfully performed until 1890 when Kelly published his first case. From this time until Lower reported 6 cases in 1925, the operation was only occasionally mentioned in the literature." (Louis M. Orr.)

E. Clay Shaw (1936) described four cases in which calculi had been removed from the lower end of the ureter per vaginam. In discussion Orr said that the total number of cases in which this method had been used was somewhere around fifty.

Removal of ureteral calculi by division of the orifice through the bladder had been reported by various operators. Some used scissors; others (Furniss) fulguration; and still others, division with a knife electrically heated.

Vesical Calculi. Since time immemorial stones have been removed from the bladder either through a suprapubic or a perineal incision. Efforts to remove calculi by instruments through the urethra has almost as long a history. Before 1890, Bigelow had produced his remarkable lithotrite and method of removing calculi by litholapaxy. Since then very little has been added to the subject except modification of the design of the instruments employed. Chismore (1884) presented his evacuating lithotrite which had the advantage that stones could be drawn in between the blades by suction, crushed and evacuated without removing the instrument. Young (1910) designed an evacuating lithotrite of much larger capacity than Chismore's and was provided with a long cystoscope. Other cystoscopic evacuating lithotrites have also been introduced, among which may be mentioned Ravich, Lowsley, etc. Kretschmer modified Young's cystoscopic rongeur by making the blades so strong that calculi

could be crushed between them. One of the most recent advocates of litholapaxy is Gershom J. Thompson.

Much has been written about the complications of vesical calculus: enlarged prostate, contraction of the vesical orifice, diverticula, etc., but we shall not attempt to analyze the literature.

Prostatic Calculi. Guyon (1899) was one of the first to present an extensive study of the pathology, diagnosis and treatment of calculi in the prostate. B. A. Thomas and J. T. Roberts (1927) in a masterly article, brought the progress of urology as applied to prostatic calculus up to date. They showed that prostatic calculi are not rare, that about 65 per cent were symptomless, that an indurated mass might be mistaken for cancer, but the diagnosis could be made by the *x*-ray in almost all cases, and that surgical intervention by the perineal route was the treatment of choice except in those cases in which the calculus communicates with the urethra, when it may be removed urethroscopically. Young (1934) presented an exhaustive study of 100 cases in a paper in which he agreed with Thomas.

Recently Gershom J. Thompson (1940) asserted that calculi might be removed with great ease by endourethral methods generally associated with prostatic resection. J. Swift Joly's "Stone and Calculous Disease of the Urinary Organs" contains much interesting data.

Preventive Treatment of Urolithiasis. Charles C. Higgins (1939) thus summarizes the therapy in urolithiasis:

1. High vitamin A, acid-ash or alkaline-ash diet to prevent the formation of calculi in patients with orthopedic conditions and in those who have passed calculi at frequent intervals, but in whom no stones are present in the kidney. The same diet may, in rare cases, be of value in dissolving calculi already present.

2. Preoperative investigation to ascertain the etiologic factors associated with the formation of the calculus.

3. Postoperative routine to prevent recurrent calculi by a high vitamin A, acid-ash or alkaline-ash diet.

4. Bacteriologic study of the organisms present and appropriate treatment.

TUMORS

Tumor of the Kidney. The most common is that described by Grawitz (1883) and supposed to be a development from adrenal rests in the kidney. Lubarsch (1894) gave the name hypernephroma. There has been much discussion as to the etiology and cellular pathology of these tumors. In 1899, Wilms described a new renal tumor which he declared to be an adenomyosarcoma. Since then, this tumor has been known as Wilms' tumor. His findings were confirmed in 1901 by Israel in his great monograph, "Chirurgische Klinik der Nierenkrankheiten." One of the most important contributions was that of Albarran and Imbert when they published their "Tumeurs du Rein" (1903).

Primary neoplasms of the renal pelvis are much more rare than cortical tumors. Meltzer (1926) was able to collect only 181 cases in the literature. Hunt (1927) in a report of 318 nephrectomies for renal tumor found only twenty-three primary epitheliomas of the renal pelvis.

Hyman (1928) showed in a collective review of ninety-nine cases that only 15 per cent of renal tumors of the kidney were cured by nephrectomy.

In 1926, Bothe found that Wilms tumors were radiosensitive. Waters, Lewis, and Frontz (1934) published a series of six cases of renal tumor in adults which had been subjected to preoperative radiation. They concluded that all large cortical renal tumors should be subjected to irradiation before operation because the marked reduction in size caused by this treatment, made operation much easier and possibly lessened the likelihood of metastases. Lawrence Wharton (1935) came to the same conclusion. All agreed that nephrectomy was the only hope of an ultimate cure. There is still much discussion as to

whether the extra- or intra-peritoneal approach is preferable in kidney tumors.

A gradually increasing number of cases have been reported in which there has been a recurrence of the epithelioma in the terminal portion of the ureter which was not removed by nephroureterectomy. The importance of complete nephroureterectomy at one séance is stressed by V. C. Hunt in a report of fifteen cases of papillary epithelioma of the renal pelvis, in 1927. In some of the cases a considerable portion of the bladder wall involved in the tumor at the lower end of the ureter was removed. After nephroureterectomy Colston destroyed the epithelioma of the lower end of the ureter by fulguration and later removed a bladder diverticulum in which a papilloma had become implanted.

Tumor of the Bladder. With the development of cystoscopy, the diagnosis and and operative treatment in tumors of the bladder made rapid progress. In 1896, Nitze introduced his operating cystoscope, an instrument with which he could snare the tumor, burn through the pedicle and cauterize bleeding vessels. He later described one hundred and fifty cases treated with his instruments and reported only twenty recurrences and one death. In 1905, Weinrich reported one hundred and one cases treated by Nitze's method with 71 per cent recurrences. Luys (1903) destroyed tumors electrically through his open air endoscope. D'Arsonval (1893) brought out the bipolar high frequency current, and Oudin the monopolar method. These were employed variously in medical practice, but apparently Edwin Beer (1910) was the first to use a monopolar current in the destruction of bladder tumors with a cystoscope, almost simultaneously with E. L. Keyes, Jr., who used the bipolar current. Both of these pioneers were greatly assisted by Reinhold Wappler who was responsible for many cystoscopic improvements.

In 1915, Geraghty, from cystoscopic observation, described four types of bladder tumor: benign papillomas; malignant papillomas, papillary carcinoma and infiltrating carcinoma. In 1922, Broders presented a microscopic classification of bladder tumors from biopsy specimens.

Endovesical destruction of tumors of the bladder by the high frequency current through a cystoscope was utilized all over the world. It soon became evident that many malignant papillomas could not be cured by this treatment, and that other papillomas, described microscopically as benign, eventually showed evidence of malignancy at the base and were not curable by the high frequency current. In 1911, Paschkis described a cystoscopic radium applicator, but he reported no cases. It was at this point that Pasteau and Degrais presented at the International Medical Congress in London (1913) a paper on the use of radium introduced into the bladder with an ordinary rubber catheter. They reported four cases of carcinoma of the bladder and prostate with beneficial results. Young (1917) introduced a cystoscopic radium applicator, the beak of which carried 100 mg. radium. The outer part of the instrument was provided with a ball that could be grasped by a clamp attached to the table and thus hold the radium in the position in which it had been placed under cystoscopic direction. He reported the use of this instrument in early malignant papillomas and also in the treatment of bases of other papillomas. Young later introduced additional instruments which could be used with the same straight cystoscope for making applications of radium by different mechanical devices to various parts of the bladder.

In subsequent publications the remarkable results obtained by a combination of fulguration and radium application were reported from the Brady Urological Institure (Scott, McKay, Colston, Geraghty and Denny).

Very extensive resections of the bladder have been reported by various operators. Hemi-section was strongly advocated for tumors involving one side of the base (Squier). A few cases were cured by these radical procedures, but recurrences were

many and the immediate mortality high. For such cases the implantation of radium through a suprapubic wound was advocated by various operators, usually after the intravesically projecting portion of the tumor had been removed by the cautery. Barringer (1915) employed radium emanation seeds which were introduced cystoscopically or suprapubically into such tumors. He and Dean have reported great series of cases exclusively treated by radium especially with gold seeds. Despite these endovesical methods it is generally accepted now that malignant, and especially infiltrating tumors of the vertex, anterior and lateral walls of the bladder and portions of the posterior wall should be attacked by radical resection of the bladder wall around the tumor. In many cases it may be necessary to go into the abdomen and excise a considerable portion of the peritoneum covering the bladder, along with the neoplasm. Young (1930) introduced a transvesical method of removing malignant tumors of the posterior wall of the bladder along with both the entire bladder wall and the peritoneum covering it. He showed that this method provided a simple way of attacking tumors of the posterior wall of the bladder without first going into the peritoneal cavity.

Deep *x*-ray therapy has long been used in the treatment of malignant tumors of the bladder and prostate. The general concensus of opinion is that it has been very ineffective. D. K. Rose (1935) advocated the application of deep *x*-ray therapy to bladder tumors which are exposed directly by wide opening of the bladder, the walls of which are held apart by special retracting instruments. By this plan the intervention of the abdominal wall and the anterior wall of the bladder are removed and the *x*-rays are permitted to operate directly upon the interior of the bladder containing the tumor. The results obtained by this method are, so far, not convincing.

Fletcher Colby (1939) reported a small group of malignant tumors of the bladder treated by supervoltage *x*-radiation with a recently devised million volt generator operated by Richard Dresser. Colby stated that "although the series is entirely inadequate to evaluate fairly this form of treatment, certain tumors appear profoundly affected, with considerable regression. Those portions of the tumor which project into the bladder cavity seem to be affected considerably more than those which have extended through the bladder wall." The help and co-operation of Dr. Richard Dresser was acknowledged.

In another paper (1940) Colby reported on twenty-four cases, among which there were seven patients whose tumors could be identified through a cystoscope. Biopsy had proved that all seven were cancer. Subsequently, these patients died of cancer or showed evidence of deep invasion. In conclusion Colby said, "Evidence collected thus far gives little support to the cure of malignant tumor of the bladder by supervoltage irradiation."

The subject of metastasis from carcinoma of the bladder was studied by Colston and Leadbetter in 1935–1936. A patient who showed no gross evidence of tumor on cystoscopy or autopsy died of brain metastasis. Microscopic sections, however, revealed cancer in the deeper portions of the bladder wall which had not been eradicated by the apparently successful use of radium and deep *x*-ray therapy.

Complete removal of the bladder, usually along with the prostate and seminal vesicles, has been advocated by occasional operators for many years. We cannot attempt to discuss this large literature. The most important problem is diversion of the urine into the intestinal tract.

Uretero-intestinal implantation has been done for various conditions. Simon, of London, is credited with having effected an anastomosis between ureters and rectum as early as 1851. Thomas Smith carried out a similar operation in two stages in 1878. Both patients died following operation. In Smith's case it was found that the left kidney was atrophic. The right kidney was hypertrophied, and the upper end of its

ureter was distended with urinous fluid. In 1892, Maydl transplanted into the sigmoid an ellipse of trigone bearing both ureters. Two years later Bergenhem transplanted extraperitoneally into the sigmoid one ureter at a time, with a rosette of bladder around the orifice. In the same year, Rein used glass tubes in the ureter to insure drainage and attached these to rubber tubes which were brought out through the rectum. The patient died from an unknown cause shortly after operation. Probably the first successful bilateral transplantation of the ureters after operation for carcinoma was by Chaput in 1896. In 1899, Peters employed Bergenhem's principle with ureteral catheters. In 1910, Coffey developed his submucous implantation in experimental animals. This technic was modified by Mayo, (1912) who used a catgut urine guide. Coffey applied his technic clinically in 1913. Cabot also modified Coffey's method by using an extraperitoneal approach (1921). Higgins, in 1933, modified Coffey's third type of implantation, by which the communication was established with transfixion sutures, and reported favorable results. Poth (1935) developed an aseptic method of uretero-intestinal implantation in two stages. At the second operation, each end of a long wire was passed up the ureter and through the uretero-intestinal septum into the bowel. These long, insulated ends were brought out through the rectum and a current applied. A longitudinal communication was thus established between ureter and bowel. In 1936, Hinman and Weyrauch published survey of the literature and collected more than 1,000 cases of uretero-intestinal implantation. Foley (1937) introduced his aseptic method.

The Coffey principle, with many technical modifications (Mayo, Cabot, Hinman, Lower and others), has received the widest acclaim. Kirwin (1930), experimenting with dogs, attempted to improve the operation but concluded that, so far as these animals were concerned, the basic design was unsound. Vermooten (1934) also working with dogs, showed that the intramural portion of the ureter was almost always bathed in exudate when the Coffey operation was used. These observations have helped to explain the relatively high percentage of poor results with this method. Growing dissatisfaction with the existing mortality rate has led some operators to adopt simultaneous ureteral transplantation in two stages. The most recent proposal is that of Jewett (1940) who, at the first stage, imbeds the ureters into the bowel wall without going through the mucous membrane. At the second stage he divides the ureters below the point of implantation and inserts an insulated electrode with which he cuts through the tissues between the lumina of the ureters and bowel on each side. He then ligates and buries the cut ends of the ureters.

Uretero-vesical Implantation. Apparently the first recorded case of successful transplantation of ureters into the bladder was that of Israel (1896). Since then, this operation has been carried out with varying success. Among those reporting successful results by improved methods are Hunner and also Toulson (1939).

Tumor of the Testicle. Wilms (1896) demonstrated the teratomatous nature of most testicular tumors. Ten years later Chevassu described a tumor composed of cells which so closely resembled the cells of mature seminal epithelium that he believed it arose from the seminiferous tubules. To this tumor he gave the name seminoma. In 1911, Ewing, after an exhaustive study of pathological specimens, came to the conclusion that all the common tumors of the testicle are of a teratomatous nature. Perhaps the most comprehensive classification of testicular tumors is that of Hinman.

Trauma has long been considered a predisposing factor in the growth of these tumors for in a large percentage of cases, a history of injury can be obtained. Coley (1923) called attention to this fact. In 1925, Archie Dean published a series of eighty-four cases of tumors treated at the

Memorial Hospital. He concluded that simple orchidectomy usually is ineffective in achieving permanent relief, and that high voltage *x*-ray therapy also should be employed.

Hinman (1936, in Cabot's "Modern Urology") says: "Of 728 testicular tumors variously reported, 11.2 per cent were in undescended testes. Among 3,646 cases of undescended testis variously collected, there were only 8 instances of malignancy. The importance of statistics of this kind rests on their value in determining whether abdominal and inguinal retention predisposes the testicle to malignant change. At present this point remains unsolved."

In 1929, Zondek discovered a follicle stimulating hormone (Prolan A) in the urine of a patient suffering from teratoma testis. Ferguson (1933) made a quantitative study of this hormone in the urine of a series of patients with testicular tumors and believed that the type of tumor could be determined from the amount of hormone present. He was able to correlate the excretion of the hormone with the histological structure of the tumor in only thirty-seven of the 117 cases. Later work by Hinman (1935) and by Dean has shown that many patients with teratoma testis do not eliminate the hormone in the urine, but when the hormone is found in the urine, it is of considerable prognostic value, for its decrease under irradiation therapy is an index of radiosensitivity.

Chevassu (1910) unsatisfied with the poor results of simple orchidectomy, devised a radical operation for the removal of testicular tumors in which the entire lymphatic system from the testicle to the preaortic group of nodes around the kidney was removed. The technic of this procedure was modified by Hinman (1914). To the present day there has been some dispute concerning the advisability of confining the therapy to irradiation alone, but most writers believe that simple orchidectomy should be carried out first. The type of tumor can be then identified and extensive irradiation therapy commenced. Hinman (1935) believes that the radical operation should still be employed in the case of radioresistant tumors if the patient is in good physical condition and presents no clinical evidence of metastasis.

Dean (1935) reports that in treating all types of teratomas by radiation he obtained five-year cures in 29.9 per cent. Dean (1935) and Randall and Bothe (1937) agreed that all cases of testicular tumor should be subjected to preliminary deep *x*-ray therapy. It was generally agreed that to be effective, the patient should have irradiation from the chin to the inguinal region whenever the biologic test shows the presence of metastasis.

In 1933, Hinman reported 17 per cent five-year cures in 109 cases which had been subjected to the radical operation. Twenty of the cases had been found to have inoperable metastasis, and forty-one of the other eighty-nine had preaortic metastasis. Four of these were known to be among the five-year cures. Among fourteen personal cases in which Hinman had carried out the radical operation, he stated in 1935 that ten patients were living from one to ten years. Seven of the fourteen patients had had metastasis, yet four had survived from one to fourteen years with good prognosis for further survival. "It is significant that eleven of the fourteen cases were the radioresistant mixed cell teratoma which otherwise would have been without hope." (Belt, 1937). Belt says that the radical operation undoubtedly has saved the lives of a number of individuals who had radioresistant teratomas, some with abdominal metastasis. It has been shown that the only hope for life in those individuals afflicted with chorioepithelioma or in those with a radioresistant tumor with cells of the adult type, is the radical operation.

Cabot (1939) studied the results obtained in 363 cases at the Mayo Clinic, of which he was able to trace 98 per cent, and reported the ultimate results. "One hundred and forty-eight patients were seen here in the first instance and the entire diagnosis and treatment was carried out at

the Clinic." These studies showed a survival rate after castration of 41 per cent for patients with carcinoma without irradiation at the end of five years and a survival rate of 27 per cent for ten years or more. Among the tumors which they classified as seminoma, "the survival rate for five years or more was 71 per cent of the fifty patients with seminoma treated with irradiation, and the survival rate of 47 per cent for the whole group whether or not treated by irradiation for a period of ten years or more. Two hundred and fifteen cases which were diagnosed and in many cases treated elsewhere, and came to the Clinic only for irradiation, were not included in the analysis."

HYPERTENSION

Hypertension has long been known to be associated with renal disease of many forms, but until recently it was believed that when renal diseases were responsible, they were always bilateral. Janeway (1909), Cash (1924), Wood and Ethridge (1933) produced hypertension in experimental animals by various methods involving injuries to the kidneys. Tigerstedt and Bergmann (1898), Prinzmetal and Friedman (1910), Harrison, Blalock and Mason (1936) all had produced hypertension by extracts from normal and diseased kidneys. Longcope and Winkenwerder (1933) in a series of patients demonstrated the relationship between hypertension and contracted kidneys due to chronic bilateral pyelonephritis.

Goldblatt and his co-workers (1937) produced hypertension experimentally by a partial constriction of the main renal arteries by means of a clamp. In 1937, Allan Butler reported two cases of hypertension in children associated with unilateral chronic pyelonephritis. In these patients the blood pressure returned to normal after nephrectomy and was still normal after twenty months in one case and three months in the other. N. M. Barker and Waltman Waters (1938) reported a case of unilateral atrophic pyelonephritis in an adult in whom nephrectomy was carried out. Following this the hypertension which was present is reported to have been cured. That same year Leadbetter and Burkland reported a case of ectopic pelvic kidney in a five and a half year old colored boy who had hypertension. The urine was uninfected. The function of the ectopic kidney, as shown by excretory urography, was somewhat impaired. Nephrectomy was carried out solely for the purpose of reducing the high blood pressure. Subsequent examinations have shown the pressure to have remained normal. Pathological study of the specimen disclosed a partial occlusion of the main renal artery by a smooth muscle plug springing from its wall. Another case of hypertension was reported at the same time by Boyd and Lewis. Removal of one kidney in which marked vascular changes had resulted in an infarct restored the blood pressure to normal.

The wave of enthusiasm for subjecting many patients with hypertension to nephrectomy resulted in a word of caution by Crabtree and Chaset (1940). In a series of 150 cases of severe unilateral renal damage, only fourteen patients had hypertension. In all except four of these, the removed kidney showed vascular lesions. Of these four cases without arterial changes two of the patients were sixty years old or more.

Braasch, Walters and Hammer (1940) have reported the results of an extensive study of unilateral atrophic pyelonephritis and have shown the relationship between this condition and hypertension. In their cases there was marked renal vascular disease.

Koons and Ruch (1940) reported one case of hypertension associated with Wilms tumor. Nephrectomy restored the pressure to a normal level.

UROGENITAL TUBERCULOSIS

Renal Tuberculosis. Since 1890, bilateral renal tuberculosis has been a frequent subject of discussion. At first, as shown by the papers of Casper (1900), Hallé and

Motz (1902), Albarran (1905), Israel (1911) and Legueu (1915), it was believed that only 10 to 20 per cent of cases showed bilateral involvement. With the advance in diagnosis, however, the percentage has been rising to agree more nearly with the autopsy findings of approximately 50 per cent bilaterality (Rafin, 1914; Medlar, 1926). George Walker (1911) proved the bilateral nature of early renal tuberculosis in rabbits by the intra-aortic inoculation of tubercle bacilli.

Lieberthal (1938) in agreement with Chute (1920) and Medlar (1926) published his theories of the development of renal tuberculosis based on autopsy, clinical, surgical, pathological and experimental evidence. He believes that the invasion of the kidney is usually by blood-borne organisms which cause lesions in both kidneys at the same time and in several places, many or all of which may heal. A single remaining focus may finally erode the epithelium and discharge bacilli into the urine, undiscovered because at this stage there are no urinary symptoms. However, some of them lodge at the apex of a papilla and form a small ulceration. Adjacent arteries may be eroded and produce miliary seeding of the cortex. As the result of bacilluria, edema and stricture of the ureter occur, causing stasis and reimplantation on other papillae. Cystitis also follows the continual flow of bacteria and bacterial products.

Whether retrograde infection of the kidney can occur is still controversial. In 1892, Albarran, by injecting tubercle bacilli into the ligated ureter, proved that retrograde infection could occur, but he felt that ureteral reflux was a necessary condition. This has been confirmed by numerous workers, including Hallé and Motz (1904), Bauereisen (1910) and Lieberthal (1938). The contrary view has been taken by G. Walker (1911) and Kenneth MacFarlane Walker (1913). Beer (1917) reported positive guinea pig inoculations with urine obtained from supposedly normal kidneys; the result, he thought, of contamination or regurgitation. In a later report with Moss, Braasch (1930) concluded that positive reports of tubercle bacilli from normal kidneys were caused by regurgitation and asserted that ascending infection of the ureter from a badly infected bladder is the usual cause of regurgitation. In recent years as studies improved, recognition of kidney involvement has increased.

In 1917, Fenger described tuberculous ureteritis and the associated "golf hole ureter." In 1918, Young described retraction of the ureter and characteristic changes in the trigone in renal tuberculosis which sometimes go on to complete undermining of the trigone.

Between 1890 and 1900 various operative procedures for kidney tuberculosis were undertaken including nephrotomy, partial resection and nephrectomy by lumbar and transperitoneal routes. With the gradual improvement in diagnosis which made it unnecessary to expose the "good" kidney, the transperitoneal route has been discontinued. Notable among the pioneers were Israel, Albarran, Tuffier and Morris. In 1900, O. G. Ramsay proved that nephrotomy and partial resection, while affording immediate relief, were accompanied by a higher remote mortality. This had also been shown by F. L. Facklam (1893). During the next ten years the immediate mortality of nephrectomy dropped steadily. Brodeur (1890) admitted a mortality of 58 per cent, Palet (1893) 40 per cent; Pousson (1902) 28.4 per cent, Wildbolz (1913) 2.8 per cent, Beer and Hyman (1920) 207 cases, 3.8 per cent, Barney (1925) 3 per cent, Young (1926) 111 cases with no deaths, (patient no. 112 died) and Caulk (1936) .7 per cent.

Since 1910, surgeons have concerned themselves with attempting to decrease the number of postoperative sinuses. Israel (1896) and Rovsing (1896) anchored the ureter into the anterior angle of the wound for subsequent irrigation. W. J. Mayo (1915) readvocated this. Borelius (1911) mentioned that he had closed several incisions tightly without drainage, and in 1912 W. J. Mayo also advocated tight closure,

after lavage of the wound with normal saline. Keyes (1939) is at present the foremost advocate of the latter procedure, and T. L. Howard (1939) of the former, both of which were popularized by Mayo. At present, the almost universal procedure seems to be to ligate the ureter as low down as possible, sometimes after the injection of 95 per cent carbolic acid. Drains are usually inserted. Numerous authors (Kelly, 1914; Caulk, 1936; and T. Leon Howard, 1939) substantiate these views. H. L. Kretschmer (1916) and Caulk (1936) emphasize the importance of removing the fatty capsule to prevent sinus formation.

Complete nephroureterectomy including a cuff of bladder was advocated by Kelly (1896) using two incisions. Others (Beer, 1921) have also used two incisions, but Caulk (1936) and others state that this procedure is unnecessary and merely adds to the difficulty of the operation.

Conservative treatment (sanatorium care and tuberculin) has been advocated for renal tuberculosis, mainly by G. J. Thomas, et al. (1938). However, most authors (according to Caulk, 1936) prefer to use conservatism only in those cases with bacilluria and no ulceration performing nephrectomy as soon as advancement of the lesion is definitely demonstrable. Parsons (1925) showed that 85 per cent of eighty-four unoperated cases were dead in five years. Wildbolz (1929) advanced this to 94 per cent of 316 cases in ten years. He presented cases of tuberculous nephritis which had apparently become arrested or cured without resort to operation, but on the other hand he quoted various authors to show that in definite ulcerative tuberculosis of the kidney, the nonoperative treatment was rarely successful. Wildbolz states definitely that clinically demonstrable caseous renal tuberculosis never becomes completely fibrosed or healed. Wildbolz agreed with Persson, Rafin, Judd and Scholl that nephrectomy never brings a cure in bilateral renal tuberculosis, nor even prolongs the life of the patient. Young (1939) recounted the case of a man with early renal tuberculosis who, after three years of the best sanatorium care and tuberculin, returned to him dying of extensive genito-urinary tuberculosis. This would seem to be rather typical. Emmett and Kibler (1938) state that in their large series of nephrectomies for tuberculosis the prognosis in regard to the good kidney is dependent upon the severity of involvement as measured by the number of white cells in its urine obtained by ureteral catheterization, in spite of negative pyelograms.

In 1890, it was already known that the bladder symptoms would usually subside after removal of the infected kidney, but only some time later was it definitely proven that in most cases the bladder symptoms were secondary to renal tuberculosis (George Walker, 1907).

In regard to the treatment of the bladder symptoms following nephrectomy, Rovsing (1907) recommended the instillation of 6 per cent carbolic acid. Vernier (1913) recommended ether vapor and Farnarier (1914) iodine vapor. Various other topical applications have been highly praised. Among these are gomenol, silver nitrate and mineral oil. Caulk and Ewerhardt (1932) recommended intravesical ultraviolet light, which they applied with a special instrument, obtaining a startling result in the one case cited.

Genital Tuberculosis. Guyon (1891), the father of modern urology, in discussing the question of genital tuberculosis, stressed the great frequency with which the seminal vesicles and prostate were the primary seat of the involvement. As a result of a study of 220 cases, he concluded that the disease most often traveled down from the seminal vesicles and prostate to involve the epididymes.

Since Guyon's article, the literature has contained many papers on the development of genital tuberculosis. There is one group who believe that in the majority of cases the seminal vesicles become involved earlier than the epididymes; another group have been just as strongly impressed with the opposite view. The reader is referred to

an exhaustive paper by Barney (1936) in Cabot's "Modern Urology" which has a full and a fair discussion of the subject.

In 1901, Young collected from the literature thirty-two cases in which operations upon tuberculous seminal vesicles had been carried out. He came to the conclusion that the results were generally bad and therefore advised against this radical operation. This stand was further strengthened by reports from Kocher's clinic which showed that after excision of tuberculous testicles, the remaining process in the seminal vesicles and prostate in many instances became so much improved as to give very little trouble. Articles by Bardenheuer (1887) and Keyes (1892) showed good results from simple epididymectomy.

A paper of great importance by George Walker appeared in 1911. He conducted a long series of experiments on rabbits by injecting tubercle bacilli into various genito-urinary organs or into the blood stream. Following intra-aortic injection, Walker found that the kidney and epididymis were most frequently the site of localized tuberculosis. Rarely was there any localization in the prostate or vesicles, but when it did occur, the epididymis might become involved later. Walker also found that when the initial lesion was in the kidney, the seminal vesicles and prostate might also be involved from that source.

Kenneth MacFarlane Walker (1913) also carried out experiments with guinea pigs and concluded that when tubercle bacilli were placed into the anterior urethra, the infection often reached the epididymis by the lymphatics and not by the vas deferens.

For ten years, epididymectomy was the procedure followed by Young and his associates. In some cases the tuberculous process in the prostate and vesicles did undoubtedly retrogress so as to become almost negligible, but frequently the outcome was not favorable. A careful study of these cases showed many in which the patient gradually became worse, the urethra and bladder were involved and death gradually ensued from generalized tuberculosis.

Young (1918) stated that he had again considered the question of the operation upon the vesicles and had developed a new technic with a long prostatic tractor that could be introduced through the urethra. With this to draw the prostate and vesicles toward the perineum, he found it much easier to remove the vesicles, ampullae and lateral lobes of the tuberculous prostate.

In 1922, Young in an exhaustive paper reviewed the literature on the pathology of dissemination of genital tuberculosis and presented fifteen cases in which the radical operation had been done. In five nephrectomy also had been carried out. There were no operative deaths. One patient died from tuberculosis a year later; the others were thought to be completely arrested.

Other papers reporting radical operations are those of Whiteside (1914, 1919), twenty-two cases; Quinby (1918), seven cases; Hinman (1928), thirteen cases; Young (1936), fifty cases. In this latter paper Young expressed the opinion that but for the radical operation, which in one-fourth included nephrectomy, many of these patients would have died.

After a very thorough analytical study of the literature, Barney (1936) stated:

> There are two schools of thought as to the origin of the lesion, it being at variance for many years. I believe that while the vast majority of cases are adequately treated by conservative surgery, there may be cases in which the radical operation might be indicated. Some of the radical surgeons feel equally open-minded. The burden of proof still rests with Young. . . . Let none of us forget . . . that the patient has tuberculosis elsewhere. . . . One must not be surprised if a fresh outbreak of the disease suddenly develops or some one of its terminal forms.

OBSTRUCTIONS

Upper Urinary Tract. The various obstructions to the flow of urine through the urinary tract, either mechanical or neuro-

genic in origin, have their greatest significance in the ultimate effect on the kidney. The term hydronephrosis appeared first in Rayer's "Traité des Maladies des Reins" (1841). Since then the condition has been described at autopsy and at operation by a multitude of writers. Attention has been directed principally to the study of the various causes of obstruction. Kelly (1914) concluded that abnormal mobility of the kidney was the commonest single cause. Young (1926) reported a series of 100 unilateral supravesical obstructions and found ureteral stricture present in forty-six, calculi in thirty-nine, movable kidney the cause in four; in nine cases, no definite cause was observed. Since then, other writers have tabulated a complete list of mechanical and neurogenic causes of obstruction. The most extensive work on the nature of hydronephrotic atrophy is that of Hinman who commenced a long series of experiments in 1918. He and his co-workers thus were able to contribute an enormous amount of valuable information to the clinical problem which is briefly and clearly presented in Hinman's "Principles and Practice of Urology" (1935).

Küster is given credit for having performed the first successful plastic operation for the relief of hydronephrosis. In 1891, he transplanted a strictured ureter to the most dependent part of a hydronephrotic sac with complete success. Fenger (1892) relieved a ureteral stricture by dividing the area of stenosis longitudinally and closing transversely—the Heineke-Mikulicz principle. Subsequently, Fenger elaborated other methods of plastic repair of the hydronephrotic sac and ureter. Cramer (1893–1894) after a longitudinal division of the ureter and adjacent part of the pelvis approximated the corresponding lips. Israel (1896) and also Kelly advised plication and other technics upon the dilated pelvis. After this many surgeons reported plastic work for strictures at the ureteropelvic juncture, but generally without success.

W. J. Mayo (1909) reported twenty-seven cases in which he had divided vessels as well as carried out plastics for obstruction at the ureteropelvic juncture.

Schwyzer (1923) published his Y-plasty operation for hydronephrosis "which he had done first in 1916" (Foley, 1937).

In 1923, Quinby reported cases in which he had reimplanted the ureter in the most dependent portion of the pelvis to avoid ligation of the vascular cord. Papin (1928) and Walters (1930) described various methods of resection of the hydronephrotic sac. In 1928, Keyes reported a successful plastic repair by intubation of the ureter. He divided the stricture and left a tube for drainage until closure was effected.

In 1937, Foley described his technique of Y-plasty for stricture at the ureteropelvic juncture and cited nineteen personal cases.

In 1932, Young reported a case of a very large hydronephrosis caused by obstruction to the ureter with a vascular cord, in which he avoided both division of the blood vessels and transplantation of the ureter by resection of large areas in the anterior and posterior walls of the pelvis. This procedure greatly reduced the size of the pelvis and in closing pulled the ureter away from the blood vessels.

Walters, Cabot and Priestley (1937) reported the results obtained in seventy-one plastic operations of various types in hydronephrosis.

Nephrostomy and ureterostomy are described elsewhere.

Stricture of the Ureter. The literature on the subject is so extensive that I can refer only briefly to it. Much of it is due to Hunner's announcement in 1911 that stricture of the ureter was particularly common in women as a result of remote focal infections. His insistence on the importance of searching for and removing such focal infections has met with general agreement, but as to the frequency of ureteral stricture, there is still much disagreement. Schreiber (1927) could not find a single instance of localized intrinsic inflammation of the ureter which could be regarded as

metastatic in character resulting from focal infection (Hinman, 1935). Nixon (1929), Frater and Braasch (1929) found no inflammatory strictures in 144 autopsies. Carson (1927) found four secondary inflammatory strictures in 185 consecutive autopsies. On the other hand, there are a great many papers in which the value of ureteral dilatation for stricture is stoutly maintained. Hunner, after an experience of several thousand cases, is equally insistent on the correctness of his stand.

Lower Urinary Tract. One of the early investigators on the embryology of the prostate was Pallin (1901). Herzog (1904), von Lichtenberg (1906) and Paschkis that same year contributed important papers on embryology. Lowsley (1912) reported the results of his investigations on the embryology. He found five distinct groups of tubules springing from the posterior urethra from which the five prostatic lobes developed. Ernest Watson (1918) described the development of the seminal vesicles, and Wesson (1920) presented an important paper on the embryology and physiology of the prostate, and particularly the trigone. Franklin Johnson (1920, 1922) presented papers on the development of the urethra and the homologue of the prostate in women.

Even brief reference to the great numbers of papers on the prostate and its various diseases is impossible. We shall pass to the subject of prostatic obstruction.

Among the many papers on the development of the obstructive prostate may be mentioned the pioneer work of Albarran (1902) and Motz (1905) who demonstrated that prostatic hypertrophy arose from the submucosal glands. Tandler and Zuckerkandl (1912) contended from their studies that the hypertrophic process commenced in the middle lobe and encroached upon and compressed the other portions of the gland. In 1923, Simonds agreed that the submucous glands were the structures that actually underwent hypertrophy, while the prostate proper became atrophic. In 1931, Alexander Randall presented his important volume, "Surgical Pathology of the Prostate." Laqueur (1934) ascribed hypertrophy of the prostate to an imbalance between male and estrogenic hormones in the blood. MacCallum (1937) presented a classic review of "Pathological Physiology of the Prostate," with a bibliography of more than 150 references. In 1940, after an exhaustive study, Deming came to the conclusion that solid fibromuscular masses in the wall of the prostatic urethra stimulated the prostatic ducts to undergo hyperplasia.

Prostatectomy. We have already mentioned Belfield's pioneer work on suprapubic prostatectomy. McGill, and Fuller (1895) followed closely and improved upon Belfield's technic. Young reported more complete enucleations through the suprapubic route when the prostate was pushed up by the insertion of a gloved finger in the rectum, and in 1900, Guiteras presented this method to the International Medical Congress in Paris, where the principles were seized upon by Freyer of London who a few months later presented the method as his original technic. With great enthusiasm he followed his initial report by additional papers with a rapidly increasing number of cases. It was not long before the operation was called "Freyer's suprapubic prostatectomy" and had been adopted throughout England and the continent. It is still widely known by his name, although the technic had been employed in America for several years before it was described by Freyer.

Bentley Squier (1911) made an important contribution to prostatic surgery when he introduced the intraurethral method of enucleation of the hypertrophied lobes.

In the ensuing years the literature was filled with reports on suprapubic prostatectomy with slight modifications here and there, the object being to make the operation more safe, to avoid fatal infections and hemorrhages. One of the most important of these was Hagner's (1914) hemostatic bag, modified later by Pilcher (1917).

Lilienthal (1902) advocated carrying out suprapubic prostatectomy in two stages, one for drainage of the bladder and the other for removal of the prostate. Keyes and others modified this technic, but introduced three or more stages, the object being to prevent suprapubic infiltration and infection. By these various procedures the mortality and ultimate results of suprapubic prostatectomy were gradually improved. Thomson-Walker advised more extensive resection of tissue at the vesical neck, particularly in the region of the trigone. The use of sutures was introduced by Judd (1916) and more complete suture of the prostatic bed was brought out by Harris, of Australia. Among the later writers, Lower (1927) has advocated the two-stage operation and the efficacy of the suprapubic route for prostatectomy. The operation has undoubtedly a very definite position and value.

Perineal prostatectomy has an even longer and more complex history than the suprapubic route. Some of the very early lithotomists occasionally extracted a prostatic lobe through the perineal incision made to remove a calculus. The most important work on this subject was a beautiful monograph by F. S. Watson who, in 1888, presented remarkable pathological specimens and reports of the enucleation of prostatic enlargement through a median perineal incision. In 1891, Goodfellow appeared upon the scene and enthusiastically advocated enucleation of the hypertrophied prostate through a median perineal incision. The operations he did largely under spinal anesthesia which had recently been introduced in America. Goodfellow's operations, carried out in various clinics over the country, led to a wide usage of his technic.

Others advocated perineal prostatectomy through a median incision, but with the mounting accumulation of cases it soon became evident that perineal prostatectomy by the methods then in vogue had many drawbacks. The median perineal incision passed back through the bulb, and the external sphincter, and was often followed by complete incontinence. Through this incision the finger was introduced and as much of the prostatic hypertrophy as could be reached enucleated. Subsequent results and autopsies showed that intravesical growths, particularly large median lobes, were frequently left behind. To obviate this, various procedures were suggested; viz., pressure upon the abdominal wall to push down the prostate, a suprapubic incision down to the bladder through which the hand was introduced to push down the prostate, and opening the bladder suprapubically (Nicol, 1894) and the insertion of the hand to push down the prostatic lobes. As all these had their objections, Albarran introduced a "desenclaveur" which he passed into the bladder through a median perineal incision and used to draw down the prostate, which he enucleated through the median incision. Parker Sims (1902) introduced his intravesical balloon which passed into the bladder through a median perineal incision, was inflated and used to draw down the prostate to the enucleating finger in the perineum. Andrews (1902) brought out a fenestrated sound which was passed through the perineal wound and was used to draw down the prostate in a similar way. Proust (1901–1903), of Paris, introduced a curved incision through which the operator reached the prostate back of the transversus perinei muscles and thus avoided injury of the triangular ligament and external sphincter. His dissecting technic was a great improvement upon previous methods. Reaching the prostate, it was bisected, grasped with forceps and removed from within the capsule. Young (1903), who had previously been employing the methods of Alexander (1894) for removing a prostate through the perineum, brought out his double bladed tractor to draw down and facilitate the enucleation of the prostate which had been exposed behind the triangular ligament and external sphincter, both of which were carefully preserved. In order to prevent injury to the veru-

montanum and ejaculatory ducts, Young employed a bilateral capsular incision through which the lateral lobes were first enucleated and then the middle lobe. The ability to see what one was doing, to arrest hemorrhage, to pack the wound to stop oozing, and the obtaining of excellent two-way tube drainage, as well as the great reduction in mortality (one series of 198 cases without death was reported) at once recommended the operation.

Space prevents even mention of the various modifications subsequently offered by Young and his associates and by Hinman, Cecil, Edwin Davis, Belt, Wildbolz, Geraghty and many others. At present, the technic most commonly employed is to open the urethra directly through the prostate for the introduction of a tractor and enucleation of the lobes through an inverted v capsular incision, and approximation of the vesical neck with the prostate below by mattress sutures of catgut around a tube draining the bladder which is also drained with an inlying urethral catheter. With adequate preoperative treatment, referred to elsewhere, careful hemostasis, hydrotherapy by mouth or intravenously, and the modern use of chemotherapy, the operative mortality has been greatly reduced, so as to be now almost nil. As the patients are often aged and have various complications, occasional deaths from intercurrent disease cannot be avoided, as after other prostatic operations in the young.

Cancer of the Prostate. Albarran (1898) was the first to call attention to the great frequency of cancer of the prostate. In a classic paper with Hallé he reported the study of 100 cases of supposedly benign prostatic enlargement in which malignant changes which he called "epithelioma adenoide" were found microscopically. This publication aroused considerable interest, and, at the Johns Hopkins Hospital, Geraghty made a careful study of the specimens removed by prostatectomy or at autopsy and concluded that many of the changes described by Albarran were not true carcinomas but were frequently seen in benign prostatic adenomas. Young (1905) reported that approximately 20 per cent of the patients who came for prostatic obstruction had carcinoma. In 1906, he and Geraghty described the pathology and reported that carcinoma was found far more frequently in the posterior lobe, whereas adenomatous hypertrophy occupied the lateral and median lobes. The two diseases often existed at the same time, each separate and distinct from the other. Young reported that in about 50 per cent of the cases of carcinoma of the prostate, benign adenoma of a different portion, generally lateral and median, was present. The frequency of carcinoma of the prostate was confirmed by Wilson and McGrath of the Mayo Clinic, and others. It was not until 1935 that Rich published his series of 292 consecutive autopsies in which he found carcinoma present in about 14 per cent of men past forty-one years of age. This paper was published in the Journal of Urology, and along with it Moore reported 242 cases in which carcinoma was found in routine autopsies of men over forty-one years of age, and an even larger percentage of the cases (18 per cent).

Radical Operation for Carcinoma of the Prostate. In 1904, Young proposed and carried out the first really radical operation for carcinoma of the prostate. The entire prostate, with a cuff of the bladder, both seminal vesicles and ampullae were removed in one piece and anastomosis between the bladder and membranous urethra carried out. In the early cases, incontinence resulted, but by modifying the technic, Young reported that in some cases normal urination followed. Other types of suture employed by Jewett, Lewis and by Vest in an effort to avoid ligating the external sphincter resulted in more frequent restoration to normal urination. G. G. Smith advocated the employment of Young's radical operation, not only in cases sufficiently early to expect a radical cure, but even in more advanced cases in the hope of

giving the patient a more comfortable life even though he died of metastases. In Young's statistics in which he recently reported nearly 100 cases were some in which the prognosis was not good on account of the size and extent of the carcinoma. Regardless of this, very careful study of the ultimate results showed that in about 50 per cent of the cases followed over five years after leaving the hospital no recurrences were reported, many of the cases having been followed over ten years, and one twenty-six years. To the surprise expressed at the almost unbelievably high percentage of cures it was pointed out that the prostate with its capsule and two surrounding fascias offers more resistance to the progress of carcinoma and therefore a better prospect for radical cure than almost any other organ in the body.

For cases of very early carcinoma with a small nodule in only one lobe of the prostate, a less radical operation in which half of the prostate with the seminal vesicle and ampulla above are removed has been carried out in a few cases. The typical completely radical procedure is, however, considered the method of choice; and if medical practitioners could be impressed with the frequency of carcinoma of the prostate and be induced to make more frequent rectal examinations, even in the absence of symptoms, it is held that radical operations in carcinoma of the prostate would give an even higher percentage of cures.

Contracture of the Neck of the Bladder. This condition was recognized by urologists of over a century ago and Mercier devised several instruments for dividing such a bar. This operation, which before the days of urethroscopy and cystoscopy was done blindly, was often accompanied by severe hemorrhage, generally did not remove the obstruction and fell completely into disuse. With the improvements made in Bottini's electric cautery incisor by Freudenberg and in America by Chetwood, contractures at the vesical orifice were frequently treated by burning through the obstruction in one or more places with an electric cautery knife which traveled in an outer or female beak similar to a lithotrite. But these methods fell into disuse, and such conditions usually were operated upon through a suprapubic incision, the bar grasped with forceps and cut away with scissors.

It occurred to Young in 1909 (1913) that this was an extensive operation to remove so little tissue, and he designed his "urethroscopic prostatic excisor" or punch to remove these obstructive masses of the obstructing tissue at the vesical orifice. In 1917, Young presented 156 cases with an exhaustive pathological report prepared in conjunction with Howard Cecil, in which the different pathological types of these contractures and bars were given in detail. There was no mortality and the simplicity of the operation was striking. In order to minimize the hemorrhage, Young (1912) presented an electrocautery prostatic excisor or punch in which a platinum ring was heated by electricity to a white heat and removed the tissue entrapped in the fenestra. In 1920, Caulk modified Young's instrument and extended the use of the punch to all types of prostatic obstruction, even those characterized by great hypertrophies. He became an enthusiastic advocate of the cautery punch operation. He eventually presented a great series of hundreds of cases with very little mortality. In the meantime, Braasch (1918) had modified Young's punch by providing a light in the inner curved beak instead of externally. Several years later Bumpus (1926) improved Braasch's instrument. Thompson provided the Braasch-Bumpus instrument with a tube along its roof to carry an insulated wire with which to fulgurate bleeding points. With these instruments, Thompson has reported a very large series of cases in which, by transurethral prostatectomy, he has not hesitated to operate upon even the greatest enlargements.

In the meantime, Stern (1926) had modified Young's original instrument by providing a high frequency loop and a

cystoscope of the McCarthy foroblique type. With this "resectoscope" he carried out excision of the prostatic tissue which was caught in the fenestra, as with Young's cold cutting punch. Collings (1926) introduced his "electrotome" for excising obstructing bars. Stern's methods were adopted and used in a considerable series of cases by Theodore Davis (1931) who introduced certain mechanical improvements. In 1932, McCarthy modified Stern's resectoscope by leaving off the fenestra and adopting a tube somewhat similar to that of his panendoscope (1910). The resection of prostatic tissue was carried out by a loop heated to incandescence by high frequency current, and bleeding points were fulgurated by a coagulating current. McCarthy's instrument has been the one employed generally, especially by Alcock, who has presented the greatest number of cases.

Many thousands of cases have now been successfully operated upon by the Young urethroscopic prostatic excisor or punch, Caulk's cautery punch, the Braasch-Bumpus-Thompson punches, and by the electrified loops of Stern and McCarthy. There is a large group of urologists who employ urethroscopic resection of the prostate in almost all cases, benign or malignant, small or large; but there is also a large group who, dissatisfied with the results obtained by transurethral resection, have been urging more and more forcibly the use of prostatectomy, especially in the larger hypertrophies. Among these may be mentioned Hinman, Cecil, Edwin Davis, Belt, Shaw, G. G. Smith, Lewis, Colston.

Obstructions at the Vesical Neck in the Female. In 1921, Caulk presented the case of a woman with frequent and painful urination. Cystoscopy showed a marked thickening in the posterior margin of the vesical neck associated with bullous edema of the urethra. With his cautery punch, Caulk removed a large piece of tissue posteriorly from the vesical neck, and the specimen showed dense sclerosis. The patient was cured. Arthur Chute (1929) related a case in which he had removed obstructing flaps at the vesical neck posteriorly through a suprapubic incision. Nesbit (1933) reported three cases in which he had removed the obstruction with the McCarthy resectoscope. In 1933, Papin reported having carried out suprapubic excision of the obstruction at the vesical neck. Fite (1934) reported a case cured by resection with the McCarthy instrument. Van Houtum (1935) described six cases which were treated by the Caulk cautery punch. Gershom Thompson (1935, 1939), Friedrich (1935) and Winsbury-White (1936) reported subsequent cases. In 1937, Caulk said that obstructive conditions at the vesical neck in the female were relatively common. He reported twelve cases in which with his cautery punch he had removed obstructive inflammatory tissue at the vesical orifice with excellent results. In 1934, Folsom and Alexander had called attention to the frequency of inflammatory conditions in which the suburethral glands played an important part. In 1938 and 1940, Young reported a pathological study of his cases which showed that the glands described by Franklin Johnson (1922) as the homologue of the prostate in the female were the seat of inflammatory changes associated with obstructions at the vesical neck in women.

Congenital Valves of the Prostatic Urethra. Although this condition was first described by Morgagni in 1717 and several cases were found at autopsy by Englisch, apparently the first case in which the valves were recognized in life and seen with a cystoscope was one of Young's in 1912. The valves were destroyed by urethral instrumentation with improvement in urination. The patient died of pneumonia later. Autopsy showed the valves, which had been ruptured, and marked dilatation of the ureters and renal pelves. In 1913, in a case in which it was impossible to pass instruments into the bladder, Young carried out a suprapubic operation, saw congenital valves through the dilated vesical neck and excised them, with a cure.

These cases were reported at the Johns Hopkins Medical Society in November, 1913, but did not appear in print until 1919 when Young, Frontz and Baldwin described twelve cases. Randall (1921) was the first to carry out fulguration of congenital valves. Hinman (1925) reported four cases treated by fulguration. In 1935, Counseller and Menville reported a case, and Keyes also reported a case that same year. Fagerstrom reported two cases in 1937. In "Genital Abnormalities, Hermaphroditism and Related Adrenal Diseases," Young published a study of thirty-two cases. The punch operation with excision of the valves had been carried out in twelve cases. Suprapubic cystotomy and destruction of the valves had been done in twelve cases. The valves were ruptured by passage of urethral instruments in two instances. There was no operative mortality. Six patients were not operated upon. In 1936, Campbell described minute instruments for electrical resection of posterior urethral valves through a child's cystoscope.

Congenital Hypertrophy of Verumontanum Simulating Valvular Obstruction. This condition may be responsible for obstructive symptoms and serious changes in the upper urinary tract, such as are seen with congenital valves. The subject was well discussed in a paper by Bugbee and Wollstein (1923).

Stricture of the Urethra. As stated before, the diagnosis and treatment of stricture of the urethra had made great advances before 1890; in fact, no outstanding contributions have appeared since then. Marion, and Cabot, and MacGowan (1923) strongly advocated radical resection of excision with anastomosis in certain cases. Keyes (1936) considered these methods unnecessarily radical. Geraghty (1906) studied a series of 400 cases. Retrograde operation for perineal stricture of the urethra, which had been introduced by Cock, was modified and improved by Young (1926). In 1929, Campbell reported 1,244 cases of which 848 without extravasation were subjected to operation. The mortality was 4.9 per cent. If 114 cases complicated by extravation were added, the mortality would be increased to 10 per cent. Of 396 patients not operated upon, thirteen died. In 1930, Lowsley advised preliminary suprapubic drainage in certain cases of stricture of the urethra. In 1931, Caulk reported that in 1,320 cases of stricture, he had performed urethrotomy forty-five times. Open operation was resorted to in only 3.4 per cent of all strictures encountered, and only 0.6 per cent in simple uncomplicated cases of stricture. In 1933, Riba and Sanner presented an electro-urethrotome for the treatment of strictures of small caliber. The subject of urethral stricture and its complications was exhaustively discussed by Keyes in Cabot's "Modern Urology," 1936.

Diverticulum of the Bladder. The operative history of diverticulum of the bladder began with a case reported by Pean (1895). He excised a supernumerary urethra and a diverticulum per vaginam in a girl of fifteen years; the operation was followed by recovery and cure. Czerny (1896) removed a large diverticulum extravesically through a transverse abdominal incision; the ureter was transplanted. An abdominal urinary fistula resulted, necessitating nephrectomy. The third case was reported by Riedel (1902) who removed a diverticulum extravesically, also through a transverse suprapubic incision. The patient died of collapse. Two years later Pagenstecker reported the fourth case. He went in posteriorly, resected the sacrum, pushed the rectum to one side, excised the diverticulum and transplanted the ureter. The final result was a urinary fistula in the sacral region. The fifth case was that of von Eiselsberg who removed a small diverticulum on the vertex of the bladder extravesically. In 1904, Young operated upon the sixth case and removed a large diverticulum extravesically through a median suprapubic incision. In this case, the orifice of the ureter opened into the posterior wall of the diverticulum. Young carried his line of excision around the ureteral orifice so as

to preserve a flap of vesical mucosa. This along with the orifice of the ureter were drawn into the bladder which was closed by sutures in the form of a Y. Young subsequently reported six cases in which he had avoided transplantation of the ureters by this simple plastic procedure. In another diverticulum, present in the same case, Young, for the first time, enucleated a diverticulum transvesically, a method which he has since employed in approximately sixty cases, sometimes with the assistance of suction to draw the diverticulum into the bladder.

Ernest Watson (1920) presented his observations in regard to the etiology of diverticulum of the bladder.

In a recent report John Dees (1940) has analyzed ninety-five cases of diverticulectomy from the records of the Brady Urological Institute.

Kretschmer (1940) reported an exhaustive study of 236 cases of diverticulum of the bladder. In addition, he appended a complete bibliography. His conclusions are that "some diverticula usually do not require removal. In large diverticula, if the ureter is obstructed and pyuria does not clear up, there are no recurring attacks of fever and urinary symptoms, or if the diverticulum does not empty, diverticulectomy should be done. Large diverticula should be removed." Usually Kretschmer does this operation first and performs resection, if indicated, later.

ANOMALIES OF THE UPPER URINARY TRACT

This subject is so vast and has occupied so many investigators in the anatomy, physiology, pathology and surgery of the conditions described that in this review it is impossible to refer to the many splendid papers and books on the subject. A masterly survey of the many aspects of this great subject will be found in Hinman's "Principles and Practice of Urology," 1935.

Pohlman (1904) showed the embryological basis for many anomalies of the kidney. Since then there have been innumerable reports in the literature. Many surgical procedures have been designed to correct the disturbed anatomic relations.

Double Kidney. Various investigators report that 3 to 4 per cent of autopsies show double kidneys (Eisendrath, 1923). Mertz (1920) found 80 per cent of double kidneys to show pathologic conditions. Braasch and Scholl (1922) reported that 54 per cent of their 144 patients with various degrees of duplication of the kidney on one or both sides had definite pathologic complications.

In 1933, Mathé carefully studied operations for partial nephrectomy or resection of the kidney. In 1912, Braasch reported that W. J. Mayo had removed the hydronephrotic half of a kidney secondary to an anomalous blood vessel, a similar sac secondary to stricture at the vesical wall and a hydronephrotic half containing a stone. According to Mathé, "Young reported the first deliberate successful resection of a double kidney. He removed the lower half of the kidney containing a calculous pyonephritis in which it was determined to carry out the operation after pyelographic study."

Following this report there was a tremendous impetus for conservative operations. In 1923, Eisendrath presented a study of eighty-two cases of double kidney in which the surgical intervention consisted of nephrectomy, fifty cases; heminephrectomy, twelve, partial pyelectomy and nephrotomy, twelve, and subsequent removal of the remaining half following heminephrectomy, six cases. In 1925, Phifer reported a case of bilateral heminephrectomy. That same year Judd reported eight cases of heminephrectomy. Walters also championed conservatism in renal surgery. Heminephrectomy in horse-shoe kidney was reported by Rovsing (1911), Brongersma (1919), Rawlings (1921), Kidd (1922). In 1924, Rathbun collected fifty-two such operations with only eight deaths, a mortality of 14 per cent. Since then, other papers have ap-

peared. Wehrbein (1940) reported a case of double kidney and ureter and bilocular bladder in a child, in which, by operation, he removed the diseased half of the kidney with its ureter and cured the bilocular bladder by division of the septum.

Foley (1928) published a case of double kidney and ureter in which, because of an impassable stricture at the bladder in the hydroureter of the upper kidney, he did a side-to-side ureteral anastomosis below the pelves and obtained a cure, (unconfirmed by pyelograms). He states that he knows of no other case or experiments of this type.

Horseshoe Kidney. In 1926, Colston and Scott stated that Vesalius and the older anatomists had already recognized the condition of horseshoe kidney in the course of dissections and autopsies. Martinow (1910) was apparently the first to divide the isthmus of a horseshoe kidney. Judd, Braasch and Scholl (1922) were apparently the first in America to divide the isthmus in order to rotate the diseased kidney and permit the ureter to lie in the normal position. Gutierrez (1934) presented a monograph on the clinical management of horseshoe kidney. He originated the term "horseshoe kidney disease" to distinguish cases of the anomaly not associated with significant pathological change from cases in which concomitant disease of the malformed kidney was present. Foley (1940) presented a complete survey of the literature and the late results of division of the isthmus and nephropexy in six personal cases. In Foley's cases, the kidneys were approached through an extraperitoneal lumbar incision. The operation was undertaken with the relief of pain as its chief objective and was followed by no mortality. He concluded that the anomaly in itself may be productive of pain and other symptoms which could be relieved by the division of the renal isthmus and nephropexy on one or both sides, to restore the normal anatomical relations.

Renal Ectopia. Augustus Harris (1939) presented three cases of renal ectopia and brought the entire subject of renal anomalies up to date.

Polycystic Kidney. This is a congenital condition whose development and pathogenesis are still unsolved. The development of pyelography and ureteral catheterization has done much to clarify and simplify the diagnosis. Operation has been considered contraindicated unless complicating conditions such as stone, etc., occur. Nephrectomy is almost never justifiable. Surgical puncture of the cysts or the marcellement of Rovsing (1911) is the most important suggestion that has been made for surgical relief. Goldstein (1935) presented an exhaustive article on the subject and advised "A New Surgical Procedure for Treatment of Polycystic Kidneys," in which a temporary nephrocutaneous fistulous tract is established in a nephrostomized, immobilized kidney. This permitted subsequent puncture of the cysts.

Anomalies of the Ureter. Anomalies of the course of the ureter include those in which the ureter is looped over a fascial band or anomalous artery leading to the lower pole of the kidney, and those in which the ureter pursues a devious course, such as winding itself around the vena cava or aorta, but the latter are relatively rare (Harrill, 1940). These abnormalities cause varying degrees of hydronephrosis and accompanying pathologic conditions which in many cases require operative intervention. Jewett (1940) proved the causal relationship between anomalies and hydronephrosis.

Anomalies of the ureteral orifice include stricture which, according to Chwalla (1925) may often be due to an embryological membrane between the lumen of the ureter and that of the vesicle, which usually disappears early in fetal life but which may remain to form the basis for the ureteroceles.

Caulk (1932) described congenital megaloureter which he said was related to Hirschsprung's disease.

In 1935, on the basis of experimental work done by Sharpe (1906) and Gilbride

(1911), Higgins performed a retroperitoneal anastomosis of a dilated right ureter into the normal left ureter because of intractable, painful, ureteral reflux. This operation had been planned on the basis of cystoscopic and pyelographic findings.

CERTAIN ANOMALIES OF THE LOWER URINARY TRACT

Epispadias. Epispadias was first subjected to operation by Thiersch (1869). His procedure considered in forming a tube from the skin along the dorsum of the penis and approximating the cut edges of the skin on each side. Marked improvement was made by Cantwell (1895) who demonstrated that the method of Thiersch simply produced a urethra on the dorsum of the penis. He proposed separating the corpora cavernosa and burying the tube of detached skin from which a urethra was made behind them and closing the corpora together in front of them. Cantwell's method was reported to be a failure by various operators because, from the lack of proper blood supply, the skin flaps from which the urethra was made sloughed. Young, in 1918, presented an operation for epispadias in which the dorsal skin from which the urethral tube was to be made was left attached to the left corpus cavernosum which was then rotated as the tube was buried beneath the two corpora cavernosa with stitches which drew them together, and then approximated the dorsal skin above them. This operation also comprised a special plastic on the glandular portion to place the urethra in its proper position. The results obtained were satisfactory.

For epispadias with incontinence, Young (1922) presented a much more extensive operation which, in addition to the technic described above, included opening the bladder, excising the redundant mucous membrane of the greatly dilated vesical neck and urethra, and restoring the muscles of the external sphincter, prostate and vesical neck by approximation with continuous sutures of catgut. As a result of this procedure, not only was an almost normal penis produced, but complete urinary control and normal interval urination were obtained. By practically the same technic, Young was also able to cure epispadias with incontinence in the female (1926).

Exstrophy of the Bladder. This is a much more extensive deformity also associated with epispadias. The open bladder, herniated upon the surface of the abdomen between the widely separated symphysis pubis and divergent recti muscles, presents a much more serious problem. By a technic similar to that employed in the cure of epispadias with incontinence, the bladder was easily restored to its normal position and shape, and the sphincter and urethral plastic procedure easily carried out. Owing to the large defect between the recti muscles, the result in the first two cases was a failure owing to a breakdown of the bladder sutures and the herniation of the vesical mass. Young then dissected a large flap of abdominal fascia, covered the great defect between the recti muscles with it, and held it in place by sutures to the walls of the great opening. By transplantation of the skin the fascial transplant was covered externally. These two plastic procedures cured the exstrophy and gave a fairly normal penile urethra, but owing to a breakdown at the junction of the bladder and urethra, fistulae resulted which as yet have not been cured by operation. The hope of curing this most terrible defect still remains to be fully accomplished. The principles and technic which should eventually lead to success apparently have been evolved. It only remains to secure healing per primam. With the use of sulfathiazole before and after operation to combat and prevent suppuration and breakdown of the operative wound, it is possible that complete success in this dreadful deformity may yet be accomplished by the technic just described.

Hypospadias. As noted above, Duplay and Thiersch before 1890 had presented their classic methods for the operative relief of hypospadias. In 1907, Bucknall

presented his technic. In 1911, Ombredanne published his operation. Various uses of pedicle flaps have been suggested by Cabot, Walters, Counseller, and Blair and others.

Bucknall's operation consisted of suturing flaps of the penis down to similar lateral flaps on the scrotum. Later the urethra was dissected from the scrotum by a long flap which is brought down to cover the raw surfaces of the penis. The scrotal wound is then closed by sutures. Churchman, Harvey and others have reported success with Bucknall's operation.

Ombredanne's operation consists of turning up a flap of skin from the penis or in successive stages from the scrotum and penis in the form of a pouch so that there is no possibility of leakage and therefore no diversion of the urinary stream is necessary. By turning up a pouch from the penis the raw surface is covered by a pierced foreskin which has previously been opened out by dissection. Part of the raw surface of the shaft of the penis is covered by lateral flaps. Reed Nesbit (1940) has modified and improved the method.

Arthur Cecil (*Tr. Am. Assoc. G-U Surg.*, 1931) in a classical article says, "Bucknall's operation cannot be done for perineal hypospadias; it cannot be done in cases of bilateral abdominal cryptorchidism where the scrotum is absent. Where a circumcision has been done previously, the Ombredanne technique cannot be used." Cecil prefers as a rule the technic of Thiersch with overlapping flaps.

In "Genital Abnormalities," etc., Young described various operations which he had used in cases of hypospadias of different types. In a recent paper (1939) he presented a special technic which provided for complete correction of the congenital chordee by excision of the fibrous bands, shortening the suspensory ligament, and incising the redundant foreskin and scrotal skin in extensive cases. Several months later, at the second operation, the penis having been completely relieved of the chordee, a new urethra is provided from the urinary meatus out to the glands. Suppuration is prevented by giving the patient sulfathiazole for two days before the operation and continuing the drug until after healing is complete (1940).

Hermaphroditism. Operations on pseudo and true hermaphrodites, or to relieve deformities, cure hypospadias, remove enlarged clitoris, and/or bring down concealed vaginae, as well as to remove adrenal hyperplasia, have been described by Broster, O'Farrell, Creevy, Young and by Novak, but lack of space prevents a discussion of this literature.

Hypospadias is so frequently associated with hermaphroditism that it will be necessary to discuss this subject, even though briefly, at this point. In true hermaphroditism the phallus is masculine in type; and if it is decided to remove the female organs, operations to form a urethra in the hypospadic phallus are necessary. In true hermaphrodites in which the female characteristics predominate and the male are removed at operation, the phallus is amputated. In pseudohermaphrodites of the male type, operations to provide a urethra for the hypospadic phallus are necessary. Pseudohermaphrodites of the female type present much more complicated problems. The phallus is often just as large or even larger than the normal penis of the same age. The vagina is often absent, undescended, opening into the urogenital sinus at the point where the urethra enters it. Laparotomy shows, as a rule, infantile uterus, small ovaries, and the presence of a prostate. All these conditions are the result of marked hyperplasia of the adrenals, which are usually many times larger than normal due to the great increase in the androgenic zone which lies between the cortex and medulla. A full discussion of this subject is to be found in Young's "Genital Abnormalities, Hermaphroditism, and Related Adrenal Diseases," and can only be referred to briefly here. The surgical operations necessitated are to amputate the clitoris, bring down the vagina to the perineum, and

carry out adrenalectomy on one side, or partial on both adrenals.

Adrenal Operations: The successful operative attack upon diseases of the adrenal cortex is of recent date. The first report of a successful operation upon an adrenal tumor was that of Gordon Holmes (1924) but operations on cases of adrenal hyperplasia are more recent. Among these may be mentioned papers by Crile, Goldzieher and Koster, Broster and Vines, Walters, Cahill and others. Crile exposed the adrenal through an incision along the lumbar muscles, or by a modified kidney incision, in 1932. Goldzieher and Koster (1935) said that both adrenals should be inspected to avoid overlooking adenoma, single or multiple. They used the extraperitoneal approach through an oblique incision of the muscles and exposed first one side and then the other. Broster (1933) reported using a transthoracic route after rib resection. Cahill (1936) said that he used an incision from the ensiform downward and outward along the costal border, palpated both adrenals and removed the one that was found to be the site of a tumor. Walters (1935) used an oblique lumbar incision such as is employed in exposing the kidney. The peritoneal cavity was opened, the pelvis and opposite adrenal examined. In 1936, Young reported using a simultaneous bilateral exposure of the adrenals with the patient lying upon his chest, through incisions along the outer borders of the spinal muscles, which were compressed by a special self-retaining retractor, thus allowing simultaneous inspection of both adrenals and the removal of one that was involved in hyperplasia. Additional cases were reported by Young in 1937. Remarkable results, with cure of virilism, have been reported by many of the operators.

Cahill (1935) found perirenal air injection, which had been introduced by Carelli in 1921, of much value in determining the presence of adrenal tumor.

Cryptorchidism. Since 1756, when John Hunter urged that nature should be assisted in every possible way to bring down a testicle which failed to descend into the scrotum, the subject has excited great interest. It has long been known that the testicle that remained in the abdomen or even in the inguinal canal failed to develop spermatogenesis and often remained very atrophic. The most important work in recent years has been that of Carl Moore (1930) who in a beautiful series of animal experiments showed that it was probably the greater heat in the groin and peritoneal cavity which was responsible for the failure of testes to go on to spermatogenesis. Recent and more extensive experience with hormonal injections has added much to our knowledge of the descensus of the testicle, as will be pointed out later on.

Innumerable procedures for cryptorchidism have been proposed, as shown in the following extensive compilation from foreign sources published by Hinman (1935):

A. Orchiopexy
   - I. Extirpation of the processus vaginalis without orchiopexy —Sergi-Trombetta, 1897.
   - II. Fixation of testicle in the fundus of the scrotum (after freeing the spermatic vessels and vas of bands, peritoneal attachments, adhesions, etc. (LaRoque, 1931)).
     - a. Original method—Rosenmerkel, 1820; Chelius, 1821; Anandale, 1879.
     - b. Separation and division of the tunica vaginalis with broad fixation of the testicle in the base of the scrotum—Schüller, 1881; Nicoladoni, Czerny, Koerte.
     - c. Purse-string suture at the neck of the scrotum near the root of the penis—Kocher, 1887; Bevan, 1899, 1903; J. Wolff, 1901.
     - d. Temporary transplantation of the testicle outside the scrotum—Hahn, 1888.
     - e. Excision of the cremaster—Felizet, 1891.

f. Fixation after herniolaparotomy—Kocher, Buedinger.

III. Fixation in the scrotum with perineal flap covering—Hermes, 1904.

IV. Traction method
  a. Traction by thread or elastic with attachment:
    1. To wire frame—Bidwell, 1893; Lanz, 1905.
    2. To thigh—Longard, 1903; Lanz, 1905.
    3. To heel—Tomaschewsky.
    4. By a stiff buried wire within the scrotum—Starr, 1908.
    5. Fixation of the scrotum to the perineum—Delbet, 1906.
  b. By operative fixation to the thigh:
    1. Skin, fascia lata pedicle flap, later transplanted—Katzenstein, 1902; Odiorne and Simmons.
    2. Fixation to the thigh with later separation:
      (a) Fixation suture only—Anandale, 1901; von Bramann, 1907.
      (b) With transplantation of the testicle—Keetley, 1894; Gelbke, 1905; de Beule, 1905; Torek, 1909 (not with traction principle, 1931).

V. Perineal fixation:
  a. Nicoladoni, 1895.
  b. With use of free transplant of fascia lata—Kirschner, 1910; Muehsam, 1911.

VI. Subcutaneous fixation by suture:
  a. To the pubic bone—Bayer, 1896; Helferich, 1899; Heinlein, 1900; Gersuny, 1905; Delbet, 1906; Zwanziger.
  b. To scrotal tissue—Kirmisson, 1901; Cudray.
  c. To the interscrotal septum—Tuffier, Championnière, Sébileau.

VII. Transplantation with the scrotum into the opposite scrotal sac, or by fixation to the opposite testicle—Walter, Gersuny, 1905; Witzel, 1905; Schaefer.

VIII. Transplantation or burial of spermatic cord:
  a. Suture in the inguinal canal only—Broca, 1899; Ruff, 1904; Mignon, Auvray.
  b. Similar with purse-string suture at the scrotal neck—Bevan, 1899; Kocher, Rieffel, Delagéniere, Negron.
  c. Similar with plastic operation at external ring—C. Beck, 1905.
  d. Similar with formation of canal in scrotum—Lotheissen, 1905; Czerny.
  e. From iliac brim to external abdominal ring—Davison.

IX. Division of spermatic vessels, if necessary—Bevan, 1903, 1904 (Riedel, Anschütz, Küttner, Moschkowitz, Czyzewski).

X. Displacement of the spermatic cord beneath the epigastric vessels—Frangenheim, 1920.

XI. Placing of the spermatic cord through the obturator foramen (performed on cadavers only), Sievers, 1920.

XII. Division of the spermatic cord—Murray, 1913 (Philipowicz).

XIII. Extension of the genital canal—Pólya, 1921 (Bonem).

XIV. Preperitoneal displacement—Rizzoli, 1885 (Schönholzer, Exalto, Brenner).

B. Transplantation in the peritoneal cavity:

I. Abdominal: Rotter, Dardel, Steinmann, Spitzy, Corner, Gohrbandt, Brenner.

II. Intraperitoneal: Brenner.

C. Semicastration: Seemann, Szymanowski, Kocher, Kopyloff, Küster, Paschen, et al.

As will be seen in the above tabulation of ingenious procedures that have been employed by scores of operators to bring the testicle to its proper place in the scrotum, several of the technics described by modern surgeons were used many years ago.

Among the methods widely employed is that usually known as the Bevan operation, but apparently presented first by Kocher in 1887. Bevan showed the importance of liberating the fibrous adhesions by freeing the testicle and cord from attachments to the peritoneum and the hernial sacs, thus lengthening the cord so that the testicle could be carried freely and loosely to the bottom of the scrotum. He stressed the importance of preserving the spermatic vessels and the artery of the vas. Bevan prevented retraction by a purse string at the neck of the scrotum.

Often the testicle is prevented from entering the scrotum by a tight external ring or an abnormal mass of fat. Studies of the literature show that the Bevan operation sometimes failed to hold the testicle well down in the scrotum and occasionally produced atrophy, probably from constriction of the cord. The method of suturing the testicle to the thigh by some of the technics mentioned above is now considerably employed with apparently very satisfactory results.

Denis Browne (1938) advises operation with the testes in the following undescended positions: "Emergent inguinal" —can be felt popping in and out of the external ring; "middle inguinal"—the testis is in a hernial sac; "entrant inguinal" —the testis is between the upper end of the inguinal canal and the abdominal cavity; and "abdominal"; but he questions whether or not one is justified in opening the abdomen. Ectopic testes require operation.

Engle (1932) caused a descent of the testes of an immature Rhesus monkey by the injection of anterior-pituitary-like principle. Goldman and Stern (1933) cured two boys with undescended testes by the same method.

Since then innumerable reports of the successful treatment of cryptorchidism by hormonal therapy have appeared in the literature. The hormone is believed to exert its effect by stimulating the interstitial cells which then secrete more male sex hormone. The controversy between those who advocate immediate surgery and those who prefer nonintervention, with or without hormonal injections, is still raging.

In a paper on "The Biological Properties of Male Gonadotropic Hormone," H. H. Cole (1936) showed that in rats receiving very high dosage the tubules of the testis show evidence of damage.

Denis Browne (1938) said, "The testis that can be pushed down over the pubic bone will invariably descend spontaneously by the time full growth is reached. A testicle that is in the inguinal canal cannot be felt through the skin. Hormone treatment will not bring down any testis that would not have descended without it, though it will hurry the descent. Whether this acceleration is worth the risk of certain disquieting possibilities is a matter of opinion."

Eisenstaedt, Appel and Frankel (1940) said, "One must differentiate clinically the testis which will descend when it reaches or approaches adult size and weight from the group of true undescended and ectopic testes, which always require operation. Retractile testes may descend spontaneously as late as the seventeenth year. Gonadotropic substance has no value in the preoperative care of true undescended and ectopic testes, and its use in retractile testes is not recommended." It may be definitely harmful in larger dosage, as they showed by experiments on rats.

The literature, especially papers by European authors, is very voluminous. For an analysis, see "Genital Abnormalities, Hermaphroditism and Related Adrenal Diseases" (Young, 1937).

MALE SEX HORMONES

Many years ago the relationship between the gonads and the sexual impulse was recognized, but only recently has any real advance been made in determining the true nature of the sex hormones and their effects when introduced into the body. Ancel and Bouin (1903) concluded from their studies that the tubular and interstitial portions of the testicle had different functions. These authors called attention to the fact that abdominal retention of the testes may not prevent the development of secondary sex characteristics, but did prevent spermatogenesis. The first attempt to transplant testicular substance in man was made by Hammond and Sutton (1912). The crude extracts injected before 1927 were so impure and of such low potency that the results obtained were insignificant.

In 1927, McGee extracted from human male urine an androgenic substance which repaired the atrophy of accessory sex organs in castrated animals and promoted comb-growth in the capon. Improvements in methods resulted in the extraction of substances which were more and more potent. In 1931, Butenandt extracted from 15,000 liters of human male urine 15 mg. of pure crystals. The following year he suggested its chemical structure, and this was confirmed by Tscherning in 1934. It was called androsterone. In 1934, Ruzicka and his co-workers synthetized androsterone from cholesterol. In 1935, David, Dingemanse, Freud, and Laqueur isolated from bulls' testes a potent androgenic substance in crystalline form which they called testosterone. In 1935, Butenandt, Henisch and Ruzicka and their co-workers synthesized testosterone.

Lower and McCullagh (1932) reported results of their experiments which convinced them that the testicle elaborated two hormones: androtin and inhibin. The latter was not isolated but was postulated to be a water-soluble substance formed by the germinal cells which acted as a control on the pituitary. These observations have not been confirmed by other investigators. A series of cases in which the enlarged prostate was treated by injections of inhibin were published.

Vest (in Young's "Genital Abnormalities," etc.), Bauer and Koch, Hamilton and also Foss reported beneficial results from the injection of testosterone in cases of hypogonadism. Since then, numerous papers have appeared in the literature. Vest and Howard (July, 1938) reported six cases of hypogonadism and two cases of pre-adolescent boys; they concluded that the injection of testosterone propionate was a satisfactory replacement therapy for hypogonadism. Since then, the hormone has been administered successfully in the form of an ointment rubbed into the skin and in tablets which can be taken by mouth. Howard and Vest (1939) were the first to implant pellets of pure testosterone and testosterone propionate beneath the skin. They showed that the absorption was continuous and even, and that the drug was effective for a protracted period of time. Testosterone has not been proved of value in cases other than those of testicular deficiency.

TRAUMATIC LESIONS OF THE URINARY TRACT

Kidney and Ureters. The history of this subject goes back to the time of Hippocrates. Tuffier (1889), Küster (1896) and Albarran (1899) advanced the knowledge of the mechanism and pathology of renal injuries and reported important operations. In 1908 Lardennois published a complete review of the subject and since then numerous papers have appeared. Rolnick (1926) reported that at the Cook County Hospital, Chicago, the incidence of renal injuries had been 1 in 3,000 admissions. The literature is cited by Gutierrez in an extensive article on the subject in Cabot. With modern urologic methods of diagnosis: *x*-ray, urograms, cystoscopy, etc., much progress has been made in the diagnosis and treatment of traumatism to the kidney, but there is still great variance of

opinion as to treatment. Albarran, Marion and Papin advocated the use of a network of catgut sutures placed around the kidney to hold the fragments in place, a method proposed by Marcille (1908). Since the introduction of ribbon gut by Lowsley (1933) he and others have used it frequently to bind together the ruptured kidney masses. A recent paper on the subject is that of Austin Wood (1937). Ureteral injuries generally are the result of accidents at operation or during cystoscopic manipulation, especially in the extraction of calculi. The use of heavy metal stilets in ureteral catheters is occasionally the cause of serious trauma to the ureter. The first case of successful anastomosis of a ruptured ureter was reported by Kelly (1892), using Van Hook's method of end-to-side invagination. The first successful transverse end-to-end anastomosis was done by Cushing (1893) and by W. Tauffer (1893). The latter used a small piece of catheter to splint the point of anastomosis, removing it before tying the last sutures. A. W. M. Robson (1896) was the first to do successfully an end-in-end anastomosis by the method of Poggi (1887). In 1897, Bovée used an oblique end-to-end anastomosis without support. End-to-end anastomosis with the help of an inlying ureteral catheter was first done by MacArthur (1925).

Bladder. The subject is vast, and cannot be fully dealt with here. Rouvillois and Ferron (1921) presented a survey of the subject. Vaughn and Rudnick (1924) advocated pneumocystography to diagnose ruptured bladder. A recent paper is that of A. R. Stevens and W. R. Delzell (1937). They report twenty-seven cases, fourteen of intraperitoneal injury with eight deaths, and only two deaths among thirteen patients with extraperitoneal injury alone. They advise exploratory laparotomy, especially in the early cases, and prefer complete suture, if possible. The treatment of shock is most important. Rupture of the bladder during urological examinations occurs only too frequently. Eleven cases of rupture during cystoscopic instrumentation are reported in "Young's Practice of Urology."

Posterior Urethra. These often occur as a result of fracture of the pelvis in which infrequently the prostate is torn from the membranous urethra. This is sometimes associated with rupture of the bladder, and all too often has received little operative relief except suprapubic drainage. Before 1890, no cases were reported of anastomosis of the ruptured posterior urethra. Where, on account of shock, the operator is unable to carry out immediate anastomosis, subsequent operations should include careful exposure of the prostate through the perineum and meticulous anastomosis to the membranous urethra around a retained catheter.

Anterior Urethra. Before 1890, operative treatment of these conditions was well systematized and no great technical advance has been made since then.

I cannot close this long but still incomplete review of "Fifty Years Progress in Urology" without expressing my sincere thanks to Hugh J. Jewett, Balcom Moore, Lloyd G. Lewis, James Semans, Richard W. Satterthwaite, Justina Hill, Bertha Trott and William Guerin.

ADVANCES IN NEUROLOGICAL SURGERY DURING THE PAST FIFTY YEARS

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A COMPLETE account of the accomplishments that have made possible the rapid advances in the surgical treatment of diseases of the nervous system during the past fifty years would encompass the contributions of investigators working in practically every field of medical science. Even to trace in detail the evolution of any particular operative procedure, would necessitate an exhaustive study of all accumulated knowledge pertaining to that therapeutic measure, an undertaking far beyond the scope of the present review. In collecting the data for this historical sketch many valuable papers have no doubt been passed over, while the concepts derived from others may have been accorded undue prominence. This is especially true of numerous ideas incorporated in papers appearing during the past decade, since some of these ideas have not been given sufficient trial for proper evaluation. A great mass of information, particularly that pertaining to anatomy and pathology, had accumulated during the eighteenth and nineteenth centuries and by 1890 the importance of its clinical applicability had become quite generally recognized.

The latter half of the nineteenth century was marked by many notable contributions that directly influenced the inception of neurological surgery. To mention but a few: Helmholtz had introduced the ophthalmoscope; von Graefe, and Hughlings Jackson had published papers concerning optic neuritis; Broca had furnished the first precise proof of cerebral localization when he demonstrated the lesion in the brain of a man who for twenty-one years had lost the faculty of speech; Fritsch and Hitzig had identified certain centers in the animal brain by means of electrical stimulation; Pasteur had established the microbic origin of disease; Virchow had brought pathological study to a high state of perfection; Lister had introduced the method of antiseptic surgery; Morton, and Simpson had demonstrated the feasibility of general anesthesia during surgical operations; Ferrier had recreated the science of experimental neurology; and Charcot, Gowers, Jackson, Marie, Duchenne, and others had correlated some of the knowledge gained in the laboratory with detailed clinicopathological studies. The work of these and others set the stage for advancements in therapy. It is, therefore, not surprising that at this time surgeons became interested in performing operations on the nervous system previously not attempted. Between 1879 and 1889 the reports of Macewen, Godlee, Durante, Horsley, von Bergmann, Keen, and Wagner indicated an active interest in this new field of surgical endeavor.

During the fifty years under consideration in the present review (1890 to 1940) it is the writer's opinion that there have been, at least in America, four major influences in the development of neurological surgery: (1) the discovery of the roentgen ray by Wilhelm Conrad Roentgen (1895); (2) the numerous technical devices introduced and the clinicopathological entities elaborated upon by Harvey Cushing during a long and fruitful career (1901 to 1939); (3) the revolutionary method of identifying and localizing brain lesions by means of cerebral aerography instituted by Walter Dandy (1918), and (4) the histological classification of the cerebral gliomas by Percival Bailey and their clinical correlation by Cushing (1925). In addition to these

monumental works a host of contributions of lesser import have furthered the evolution of neurological surgery as practised today.

EXPERIMENTAL, DIAGNOSTIC AND TECHNICAL ADVANCES

Clinical neurology stands today as it did fifty years ago, the vanguard of neurological surgery. The names of Rolando, Goll, Flourens, Bouillard, Bright, Dalton, Ferrier, Flechig, Monk, Frank, Gudden, Henschen, Monakow, Fritsch, Hitzig, Turck, Gaskell, Luciani, and Galtz are a few of the many noteworthy contributors who laid the very foundation stones for further progress. Near the turn of the nineteenth century several important studies were conducted in the laboratory of Sherrington, in particular his analysis of the segmental reflex mechanisms (1896 to 1906), the elucidation of the significance of the decerebrate posture (1897 and 1898) and the careful study of the motor area in the anthropoid ape (1901 to 1903), deserve attention. Precise identification of the visual cortex resulted from the work of Schäfer (1888), Henschen (1890), Minkowski (1911), and Holmes (1918). Cushing and his associates reported on the distortion of the visual fields in a series of six papers, the last of which appeared in 1922. The development of a new branch of neuroanatomy, architectonics, by Brodmann, Campbell, and by Vogt (1903 to 1905) was made possible by the utilization of the new impregnation methods (Cajal) for histological study. The studies of Ramon y Cajal and his pupils stand as the most important advance in the clarification of the histology of the nervous system. In 1889, von Bergmann published a book in which operations for brain abscess, brain tumor, epilepsy and other neurological disorders were described. Charles Dana's "Textbook of Nervous Diseases" appeared in 1892 and in 1893, M. Allen Starr completed a volume on brain surgery, devoting chapters to cerebral palsies in childhood, epilepsy, trauma, abscess of the brain and brain tumors (including a tabulation of six hundred nonoperated cases of brain tumor, three hundred of which were in children). By 1910, several comprehensive monographs had appeared on the subject of brain tumor, Oppenheim's "Die Geschwülste des Gehirns" (1896), Duret's "Les Tumeurs de l'Encephale" (1905) and Bruns' "Die Geschwülste des Nervensystems" (1908).

Another important step in the advance of the localization of cerebral function was ushered in by the experimental studies on the hypothalamus, begun in 1909 by Karplus and Kreidl. Camus and Roussy extended this work and reported on the results of experimental lesions at the base of the brain (1913 and 1914). About this time work on the pituitary body was given impetus by the excision of this gland in the dog by Cushing with the production of the adiposogenital syndrome and the criticism of his work by Aschner (1912) who suggested that injury to the base of the brain might account for some of the experimental results. It is true that the foundations for their work were laid earlier by Minkowski (1887) who was the first to suggest the causal relationship between the hypophyseal gland and acromegaly. Marie, in 1884, clearly described the clinical syndrome of acromegaly. The classical case report of Fröhlich (1901) drew attention to the fact that all pituitary tumors were not associated with acromegaly. There followed a period of confusion of the interpretations of the symptoms and signs of hypothalamic lesions with those of pituitary origin.

During the second decade of the present century several new syndromes pertaining to clinical neurology were described: the syndrome of the foramen lacerum posterius, Vernet (1916), the syndrome of the retroparotid space, Villaret (1918), and Wilson's disease, described in 1912. In 1915, Jelliffe and White published a treatise on diseases of the nervous system. Holmes contributed greatly to our knowledge of the physiology of the cerebellum. In 1911, Head and Holmes and in 1918 Holmes reported on

the nature of the cortical sensory processes in man. Investigation concerning the extrapyramidal motor system was published by the Vogts in 1919, later by Adie and Critchley (1927), Fulton and his associates (1932 and 1933), and by Richter and Hines (1932). In 1921 appeared the classical paper of Bailey and Bremer on diabetes insipidus. The syndrome of gigantism was given a sure footing by the publication of Evans and Long in the same year. Then in 1929 Putnam, Benedict and Teel reported the production of acromegaly in the dog, comparable to that seen in man, following the repeated injection of an alkaline anterior lobe pituitary extract. Penfield described sympathetic epilepsy in 1929. Cushing (1932) reported on the reaction produced by drugs injected into the lateral cerebral ventricles. The control of autonomic functions by the cerebral cortex was being investigated by Beattie, Brow and Long (1930). The importance of the hypothalamus in heat regulation was demonstrated by Keller and Hare (1932). Davis, Cleveland and Ingram (1935) protected the pancreatic animal against diabetes by a properly placed hypothalamic lesion. The report of Tower and Hines (1935) aided in the clarification of the pyramidal syndrome.

Many other contributions, both clinical and experimental, that have advanced our knowledge concerning the localization of lesions of the nervous system might rightfully have been included here. These have been reviewed and critically analyzed in several important books devoted to disease of the nervous system. Among these may be mentioned: Brain and Strauss' "Recent Advances in Neurology" (1929), Wechsler's "Textbook of Clinical Neurology" (1929), S. A. Kinnier Wilson on "Modern Problems in Neurology" (1929), "The Basis of Clinical Neurology" by Brock (1937), and "Physiology of the Nervous System" by Fulton (1938).

Quincke is credited with the introduction of the method of lumbar puncture in 1891. There followed a description of a syndrome by Froin in 1903 which now rightfully bears his name; the double spinal puncture of Marie, Foix and Robert (1913); in 1916 a test to determine the patency of the spinal subarachnoid space by Queckenstedt; and in 1920 cisternal puncture by Ayer. Important studies of the cerebrospinal fluid were carried out, cytological (Widal, Sicard, Ravaut, 1900 to 1901); serological (Levaditi and Marie, 1906; Plaut, 1909); chemical (Mestrezat, 1911, 1912; Lange, 1912); biological (Kafka, 1911 to 1930), and recently a critical analysis of the present-day knowledge concerning this fluid (Merritt and Fremont-Smith, 1937). In 1921, Sicard advocated spinal subarachnoid injection of lipidol for the roentgenographic localization of intraspinal tumors. Dandy (1919) had preceded this with the prediction that air would come to be used as a diagnostic measure for intraspinal lesions and in 1922 first reported on this method.

Ventricular puncture was used as a therapeutic measure long before it became a diagnostic procedure. It is said that Dean Swift was treated for hydrocephalus by this method. Ventricular drainage was suggested by Wernicke in 1881, by Zenner in 1886 and by Keen in 1888. Von Bergmann tapped the ventricle of a patient with brain tumor in July 1887. In this country Keen was probably the first to utilize this method (January 11, 1889). Cushing is credited with the popularization of the procedure during operations on the brain (in 1906 he advocated leaving a lumbar puncture needle in position for the reduction of pressure during the course of operation on the cerebrum but later substituted ventricular drainage for this purpose). In 1904 Neisser and Pollack described a method of brain puncture to obtain tissue for histological study but this means of diagnosis has never gained wide-spread usage in the United States. In 1895, Roentgen, while experimenting with a Crookes tube, realized the unusual ability of the rays to penetrate the body and thus paved the way for the use of the ray which now bears his name. The Coolidge tube and the Potter-Bucky diaphragm (both introduced in

1913) improved the quality of roentgenography. In 1918, Dandy described the method for demonstrating the size and position of the cerebral ventricle by roentgen ray examination following replacement of ventricular fluid with air. At this time the procedure had been carried out in twenty children to diagnostic advantage. It was pointed out that in an analysis of one hundred cases of brain tumor by Heuer and Dandy in 1916, only 6 per cent of the tumors cast shadows on the roentgen ray films. Dandy stated that his studies on ventriculography were suggested by the oft repeated comment of Halsted on the remarkable power of intestinal gas "to perforate bone" as visualized on the roentgen ray film. In 1919, he reported on the roentgenography of the brain following injection of air into the spinal canal. Subsequently (1920) he published an article on the use of ventriculography as applied to adults. Naffziger (1925) indicated that the position of a calcified pineal body as shown on the roentgen ray films aided in determining the location of a space-occupying lesion within the cranial cavity. In 1922, Dandy described the use of a ventriculoscope (at first a small cystoscope was employed and later a specially designed ventriculoscope) which was utilized for visualization of the lateral ventricles, and when indicated, for fulguration of the choroid plexus. In 1929, Hans Berger reviewed the accumulated knowledge relative to "brain waves" and reported on his investigations in this field. This type of examination was designated electroencephalography and is now being widely employed; however, its ultimate importance in clinical diagnosis awaits further investigation. Moniz, Pinto and Lima described a diagnostic procedure in 1936 calculated to provide a differential diagnosis between meningiomas and other cerebral tumors by the use of a radiopaque material injected into the previously exposed internal carotid artery. The method has not been generally used in America except for demonstrating lesions implicating the blood vessels of the intracranial cavity. The work of Bailey (1926) on the histological classification of tumors of the glioma group may properly be mentioned under the section dealing with brain tumors. The investigations, however, seem to deserve inclusion here since the verification of the histological nature of a tumor when exposed at operation is of inestimable importance and frequently influences the extent of the surgical procedure to be performed.

With the advent of cerebral surgery it was noted that following an unsuccessful attempt to remove a cerebral neoplasm the patient was often relieved of "the classical symptoms" of brain tumor, at least for a period. Robert F. Weir is cited by Cushing (1909) as being the first to suggest the possibility that a cranial exploration might afford relief though no tumor be found. Sir Victor Horsley (1890 and 1893) was the first to advance the idea of a premeditated craniectomy for the relief of the more distressing symptoms of brain tumor, especially the preservation of vision, regression of papilledema and relief of headache. Jaboulay coined the term "trepanation decompressive" in 1896 from these palliative operations and apparently they were performed in any area of the cranium elected by the surgeon. Sanger later advised the positioning of the craniectomy over a relatively "silent" area of the brain.

Cushing published his method of "intermusculotemporal procedure" in 1905. Selecting a "silent" area protected by muscle, he removed a 6 by 8 cm. piece of bone beneath the right temporal muscle, the forerunner of the now classical subtemporal decompression. Among contemporary surgeons there was a reluctance to open the dura for the purpose of decreasing pressure. Sanger advocated ventricular puncture and Broca and Maubrac lumbar puncture to reduce the intracranial tension. Cushing advised against this latter procedure in cases of brain tumor, except to measure pressure, and mentioned a fatality following removal of about 10 cc. of cere-

brospinal fluid by the lumbar route. Methods of repairing cranial defects were already being considered although it is true that many surgeons thought the restoration of the cranial contour of little importance and boldly sacrificed large areas of bone in exposing the brain. Cushing also described the suboccipital decompression which was not unlike that used today except that the posterior collar of the foramen magnum was not usually removed; however, the cross-bow incision was made, with division of the posterior cervical muscles in the midline. Frazier advocated division of the occipital sinus as an aid in the exposure of the cerebellar hemisphere.

In a subsequent paper by Cushing (1908) certain refinements were described: shaving the scalp on the day of operation; placing the patient on the table before inducing anesthesia; the recommendation that ether be used; records of blood pressure and pulse plotted during operation; preparation of the scalp with alcohol and bichloride; scratching the skin to mark the site for incision; bichloride gauze over the operative field; head rest for occipital work; pinning sheets to the scalp, etc. Advances in the osteoplastic flap operation were recorded: Wagner was the first to expose the brain by this method; Toison suggested the use of a chain-saw for cutting the bone flap; Obalinski recommended the use of the saw devised by Gigli for obstetrical purposes; Stellwagen designed a curved saw operating about a fixed point; Cryer, Sudeck and Sykes each described motor driven saws; Doyen used a motor with a flexible handle, and Borchardt, Barcut and Hartley each devised motor-driven cutting tools. The Galt conical saw was in popular use as the instrument of choice in making the primary cranial opening. Hartley and Kenyon advised breaking the flap with the temporal bone as a base, for this site was thin and muscle provided good nourishment for the flap. Cushing made a beveled flap with the aid of a Gigli saw and employed a grooved director in opening the dura. Round-pointed, fine, cambric needles were suggested for approximating the edges of the scalp. He advised against decompression operations over vascular tumors since this might result in intratumorous hemorrhage. A second paper by Cushing published in the same year deals with the use of the subtemporal decompression in the treatment of extradural and subdural hematomas and other complications resulting from trauma of the head.

In another paper Cushing (1909) described a spoon spatula for retracting the brain while exploring beyond the bony margins. The report presents the idea of combining a decompression opening with an osteoplastic flap. In addition to these features there are also mentioned, probably for the first time: clamping of the galea and reflecting it over the cut edge of the scalp rather than an attempt to clamp the divided blood vessels individually; the use of cotton pledgets instead of gauze for intracranial work; the use of minute Mikulicz pads; striated muscle as an aid to hemostasis; silver clips for hemostasis; careful separate closure of the galea aponeurotica by interrupted, fine, black, silk sutures; and the plotting of ether tension during the operation (Boothby, 1913).

In 1920, Cushing described the straight incision for subtemporal decompression as now employed stating that the curved one interfered with the cutting of an osteoplastic flap should this type of operation subsequently be indicated. Other noteworthy improvements were: gray sheets for final draping of the patient; control of hemorrhage by digital pressure while applying clamps to the galea; ventricular puncture to lessen tension and also as an aid in diagnosis in certain cases; use of headlight in a semidark room, etc. These and other technical details advocated by him have assumed considerable importance since the so-called Cushing ritual has so greatly influenced progress in neurological surgery in America.

BRAIN TUMORS

To Godlee goes the credit of being the first to operate on a clinically localized neoplasm of the brain. Bennett advocated the operation and on November 25, 1884, Godlee removed a walnut-sized, hard, glioma, lying one-fourth of an inch below the cerebral cortex, through a one inch incision in the ascending frontal convolution, avoiding the cortical blood vessels. Hemorrhage was arrested by the use of a galvanocautery and the "wound brought together with sutures." By the middle of the ensuing month the patient had recovered from the operation but a cerebral fungus was present and the paresis in the opposite lower extremity had increased. Shortly thereafter the patient died. About six months after the heroic effort of Godlee, Durante successfully removed a brain tumor. Requiring but an hour for the operation, on June 1, 1885, he opened the frontal bone and scooped out a meningioma, packing the nasal cavity with gauze (the cribriform plate had been eroded). For several years the patient remained symptom-free but finally succumbed following an attempted removal of a recurrence of the tumor some twelve years after the original operation. Keen (1888) reported the successful removal of a convexity meningioma and by the turn of the century the literature was replete with the description of surgical procedures carried out on various types of intracranial tumors.

The syndromes produced by the pituitary adenomas received rather critical attention. Horsley was an early worker on this gland but Cushing was the prime mover behind the clinical advances in this field. Caton and Paul (1893) acting on Horsley's suggestion were the first to attempt an exposure of the hypophysis utilizing a lateral subtemporal opening, however, the operation was terminated without exposing the pituitary. Intracranial procedures of a radical nature for the exposure of the pituitary body were proposed by Horsley (1904) and by Krause (1905), the chiasmal area to be visualized by elevating a frontal lobe of the brain. It appears that Borchardt (1907) was the first to put this suggestion into practice. In 1907 Schloffer performed the first fairly successful operation on a tumor of the hypophysis approaching the area by the transnasal route. Kanavel (1909) modified the intranasal procedure and the next year Halstead, and Hirsch added other technical variations to the operation. To Cushing belongs the credit for perfecting the intranasal operation which came to be known as the transphenoidal route for exposure of the pituitary gland. The technique was described by him in his 1912 monograph, "The Pituitary Body and its Disorders." The transphenoidal operation gained in favor and was used by Cushing in particular. The presence of suprasellar extension of pituitary tumors, approachable only by the subtemporal or transfrontal route seems to have encouraged the more frequent use of the intracranial operation. Eventually, the exposure of the chiasmal region by a frontal bone flap and elevation of the frontal lobe became almost universally adopted as the procedure of choice not only for tumors of the pituitary gland but for other neoplasms encountered in this region.

The acoustic neuromas form another chapter in the history of neurological surgery which illustrates the remarkable reduction in mortality that has come about through a better understanding of pathology coupled with newer technical advances. Although these neoplasms were among the first to be attacked surgically, their inaccessibility led to a high percentage of failures. In 1913, Tooth reported a 58 per cent mortality in twelve cases; twelve of von Eiselsberg's sixteen cases ended fatally and Krause had thirty-one patients of whom twenty-six died. Cushing's monograph on the subject appeared in 1917 and the recorded mortality of 20 per cent indicated the improvement that he had made in the diagnosis and treatment of these tumors. Details of the cross-

bow incision and removal of the posterior collar of the foramen magnum were presented, a distinct improvement over the previous approaches which were often made without adequate exposure. In 1922, Dandy proposed a method for the total extirpation of these tumors (heretofore the operation had consisted of intracapsular removal) and in 1932 he advocated that they be removed through a unilateral approach. Horrax (1938) advised amputation of the lateral one-third of the cerebellar hemisphere on the involved side, complete removal of the tumor and a thorough cleaning out of the internal auditory meatus.

In 1922, Dandy, in an article entitled the "Treatment of Non-encapsulated Brain Tumors by Extensive Resection of Contiguous Brain Tissue," advanced the idea of premeditated lobectomies as an aid to the prevention of recurrence of malignant brain tumors or at least an effort to deal with these in a radical manner. In a subsequent paper, published in 1925 he advocated the deliberate removal of lobes of the brain, when feasible, to afford adequate visualization to certain deep-seated lesions and to lessen the trauma incidental to their removal. In this article the use of concealed scalp incisions were recommended. In 1928, he extended the idea of lobectomy and advised right hemispherectomies for malignant lesions of the right cerebral hemisphere when it appeared that function of the opposite side of the body had been permanently lost by the destructive action of the tumor or if such a radical procedure offered some hope of cure.

Out of chaos came some order concerning the large group of gliomas when in 1926 Bailey and Cushing published their monograph on this subject. One of the important facts clarified by this study was that about 40 per cent of the classified gliomas represented fairly benign lesions. Although considerable knowledge has accumulated concerning the life history and the pathology of the malignant gliomas, up to the present little progress has been made in the treatment of these tumors. It is becoming increasingly evident that unnecessary surgical mutilation only adds to the incapacitation of the patient and does not lengthen his life. Roentgen ray therapy has likewise proved discouraging in the treatment of these lesions. Two years after the appearance of the above monograph another was published by Bailey and Cushing on tumors arising from the blood vessels. Perhaps the most important advance made here was the recognition of the benign character of the hemangioblastomas which present a favorable outcome second to no other neoplasm encountered within the cranial cavity. The monograph of Dandy, "Benign Tumors in the Third Ventricle of the Brain: Their Diagnosis and Treatment," which appeared in 1933 and a second monograph by the same author in 1934, "Benign, Encapsulated Tumors in the Lateral Ventricles of the Brain: Diagnosis and Treatment," have established methods for the successful management of these lesions.

The advances made in the therapy of meningiomas encompass the delineation of the following syndromes: (1) meningiomas of the olfactory groove (Cushing 1927) (Durante's case operated in 1885 was of this sort); (2) suprasellar meningiomas (Cushing 1903); (3) meningiomas of the sheath of Schwalbe (Cushing 1937). Cushing and Eisenhardt's recent publication, (1938) "Meningiomas," gives an excellent account of the advances made in the diagnosis and treatment of these tumors. Although a benign lesion, they often presented a special problem in the control of hemorrhage and it was not until the introduction of the suction apparatus and the electrocoagulating unit (Cushing and Bovie 1928) that the surgeon had at his command technical methods by which the field of operation could be kept reasonably dry. Although the diagnosis and treatment of many types of tumors encountered in the intracranial cavity have been brought to a high state of perfection, there still remains a large group of malignant gliomas for

which no curative surgical measure is as yet available.

SPINAL CORD TUMORS

It was in 1823 that Sir Astley Cooper made the far-seeing statement, "Though I may not live long enough to see the operation (referring to laminectomy for treatment of injuries to the spine) frequently performed, I have no doubt that it will be occasionally performed with success." To this statement, Sir Charles Bell responded, "We must submit to hear many strange proposals for the improvement of our profession in the present day from young men ambitious of notice, but that a man of Sir Astley's years and station should talk as he has done before students and given them his authority for laying a patient upon his belly and by incisions laying bare the bones of his spine, breaking up these bones and exposing the spinal marrow itself, exceeds all belief."

Something was known regarding the functions of the spinal cord as long ago as the early part of the Christian era, for in that time Aretaeus recognized that the paralysis produced by pressure on the cord may at times be homolateral. Apparently, Morgagni in 1769 was the first to speak of compression of the spinal cord by tumor. Horsley was the first to remove a spinal cord tumor (June 8, 1887, a little more than two years after Durante first successfully removed a brain tumor). The patient was a forty-two year old male, paraplegic and incontinent, with loss of cutaneous sensation below the level of the fifth dorsal dermatome and suffering severe pain. Horsley exposed and removed an intradural fibromyxoma attached at its lowest portion to the highest root of the fourth thoracic spinal nerve on the left. A year later the patient was well, walking about and free of pain. Interest in spinal cord tumors was extended and the names of Horsley, Frazier, Krause and Elsberg are outstanding among those who devoted considerable time to the diagnosis and treatment of these lesions. Possibly Braum (1906) was the first to initiate intramedullary surgery of the spinal cord. Various syndromes resulting from intramedullary and extramedullary tumors were described, methods of performing osteoplastic laminectomies, hemilaminectomies and other technical features were brought forward by several authors. The syndromes of lesions at various levels of the cord were elaborated and voluminous writings appeared devoted to the subject, including a book on surgery of the spine and spinal cord by Frazier in 1918. A volume devoted to the diagnosis and treatment of surgical diseases of the spinal cord and its membranes by Elsberg was published in 1916 and in 1925 there appeared a monograph on tumors of the spinal cord by the same author. However, errors in localization and confusion over the positive preoperative identification of the presence or absence of intraspinal space-occupying lesions, made apparent the need for more precise methods of localizing spinal cord tumors, a need partly fulfilled by Sicard's method. Within the past decade many worthwhile articles concerning the diagnosis and treatment of spinal cord tumors have appeared in the literature but no major change in the fundamental principles of exposing and removing these lesions has been proposed.

In 1911, Middleton and Teacher described the posterior prolapse of an intervertebral disc which was impinging on the lumbar enlargement of the spinal cord. They found only one other reference on this subject (Kocher). Recently Love and Walsh quoted Virchow as having mentioned such a finding. The work of Schmorl and Andrae, whose researches have been summarized by Beadle (1931), has added much to our knowledge of this structure. Seemingly the lesions that we now recognize as herniations of the intervertebral disc into the spinal canal had previously been recorded under the caption, "chondromas of the intervertebral cartilage." Dandy, in 1929, described the removal of dislodged intervertebral cartilage in two patients suffering from cauda equina com-

pression and ascribed the etiology of the lesion to trauma. Mixter extended this work and soon a new syndrome was elaborated, that of retropulsion of the nucleus pulposis. The reports from the Mayo Clinic have elaborated upon the subject and accordingly have aided in the establishment of a fairly well delineated entity.

Tumors of the peripheral nerves and those arising from the sympathetic system have received attention and several noteworthy contributions concerning their treatment have been recorded. The surgical approach to these problems has undergone few significant changes during the past fifty years.

CRANIAL NERVE DYSFUNCTIONS

The operations devised for disorders affecting the cranial nerves have been palliative procedures consisting of partial or total division of the nerve supplying the motor or sensory field implicated. These surgical procedures are: intracranial section of the dorsal root of the fifth cranial nerve for tic douloureux and other painful afflictions involving the face, nose or mouth; extracranial interruption (anatomical or physiological) of the seventh nerve for certain facial spasms; partial or complete division of the eighth cranial nerve for the relief of Meniere's syndrome; division of the glossopharyngeal nerve for neuralgia; section of the cephalad third of the tenth cranial nerve for laryngeal pain; and cutting of the eleventh cranial nerve for spasmodic contractions of the sternomastoid muscle. In addition the eleventh and twelfth cranial nerves have been employed for spinofacial and hypoglossofacial anastomosis in an attempt to relieve facial spasms and as an aid in the restoration of function in instances of paralysis of the face.

The evolution of the surgical treatment of tic douloureux rather characteristically exemplifies the development of modern neurological surgery. The first recorded account of this disease, illustrated by the picture of a physician, Johannes Laurentius Bausch, himself a sufferer of the malady, was published in 1671 but it was not until 1884 that the idea of operating on the Gasserian ganglion was set forth by J. Ewing Mears. Horsley was the first to perform an intracranial division of the second and third branches of the trigeminal nerve by the temporal route for tic douloureux on November 15, 1888. On December 11, 1890 a second patient was operated upon at which time Horsley attempted to excise the ganglion, but, with a fatal outcome. On April 2, 1890 Rose, another English surgeon, excised the ganglion piecemeal. The pain was relieved but the patient lost the eye on the affected side. On May 11, 1891 Novaro performed a partial resection of the ganglion which resulted in a cure. Andrews, an American, successfully operated upon a patient with major trigeminal neuralgia in 1891. In May 1892, Hartley perfected the technique of the temporal route which had been introduced by Horsley. By 1892, Rose had performed seven operations. Krause, following the lead of others, carried out the operation on thirty-three patients between 1893 and 1903 with only three failures. In 1890 Horsley, then Macewen and after him Princeteaux attempted preganglionic section of the nerve but all the patients died. In 1901, Frazier put into practice the retroganglionic operation that had been suggested to him by Spiller in 1898. In America the technical refinements in conducting this operation greatly decreased the mortality. In 1903, Van Gehuchten reported the results of his researches, showing that division of the posterior root resulted in a permanent destruction of the central part of the sensory pathway. In 1925, Frazier after having used the method for ten years advocated that only the outer part of the dorsal root be divided in order to spare the innervation of the cornea. His anatomical studies indicated that the disposition of the fibers of the dorsal root was such that cutting the outer two-thirds of this structure would spare the eye and the cutaneous

innervation of the forehead. Finally, the operation was so perfected that large series of cases of major trigeminal neuralgia treated by surgical division of the dorsal root were reported (Cushing, Frazier) with a mortality of about 1 per cent. No further notable changes in the technique of the operation were advocated until 1925 when Dandy reported his results following partial section of the root of the trigeminal nerve, approached by way of the posterior cranial fossa and divided close to the pons. In 1929, in a very comprehensive paper on the subject, the results following partial division of the nerve at the pons were described. This reopened the discussion relative to the disposition of the fibers in the root. Frazier had previously expressed the belief that there was a more or less systematic arrangement of the fibers; Van Nouhuys (1930) reported that the fibers were variable in disposition, and Sicard (1932) after a study of forty-two macerated specimens, arrived at the disquieting conclusion that no two specimens examined were exactly alike. Many conflicting reports concerning the clinical results obtained following partial section of the dorsal root are now appearing in the literature. The significance of these cannot be evaluated at the present time. The last contribution concerning the relief of pain in the face is the method of tractotomy of Sjöqvist. The results following this procedure will likewise await further trial.

The interruption (physiological or anatomical) of the conductivity of a facial nerve for spasmodic contraction of the facial muscles has been advocated. As stated, spinofacial and hypoglossofacial anastomosis have been performed for facial paralysis, Ballance (1895); Kennedy (1899); Barrago-Cravella (1901); Beck (1909). Kennedy was the first surgeon to perform an anastomosis between the seventh and eleventh cranial nerves for facial spasm and Gibson probably the first to utilize the twelfth cranial nerve for this purpose. Several surgeons have extended the work; however, no notable contributions to these procedures have been made within recent years.

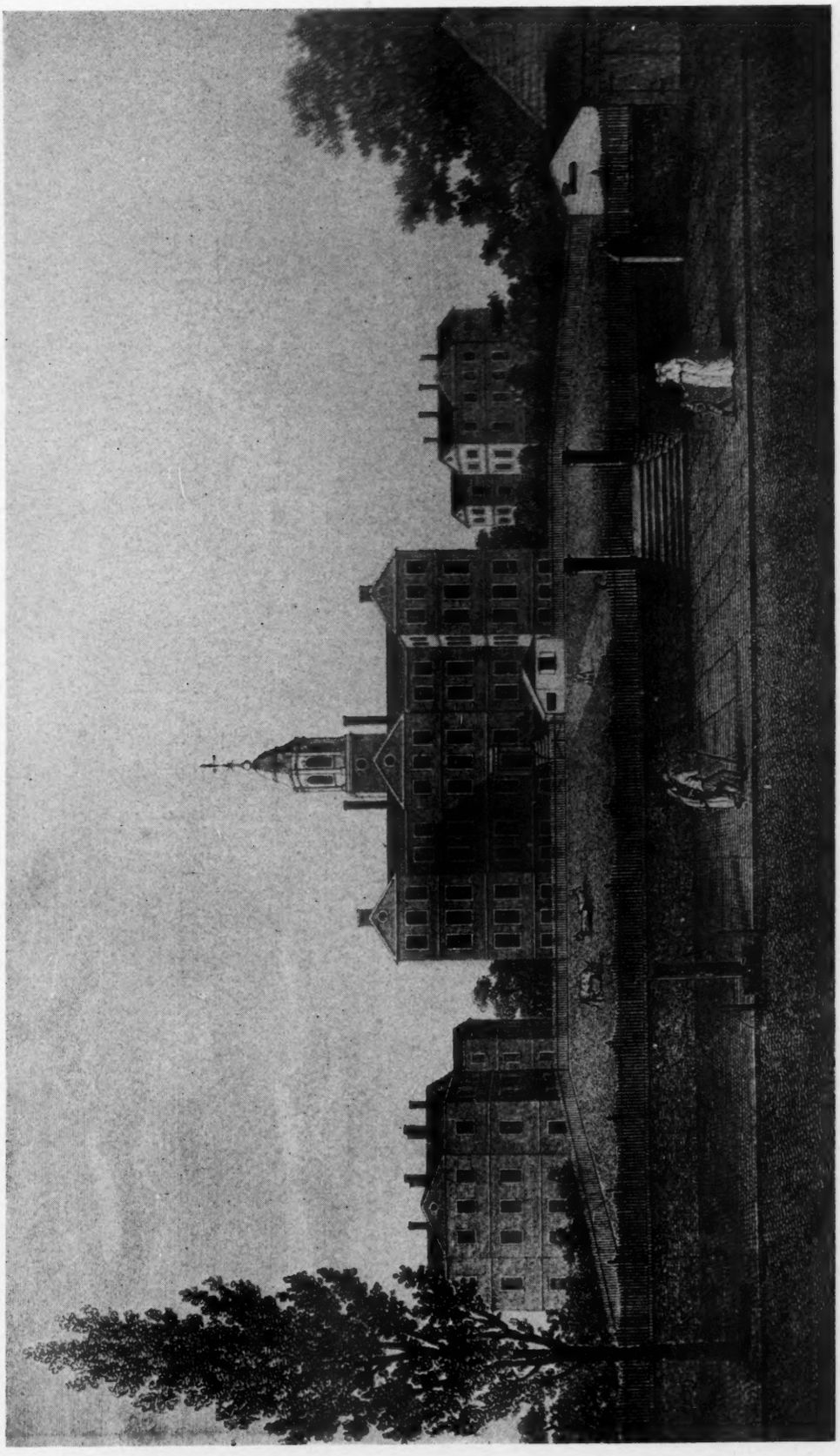
According to Dandy, Charcot suggested that since the symptoms of Meniere's syndrome ceased after deafness occurred, surgical section of the nerve would probably alleviate the symptoms. In 1899, Ballance advanced the idea that surgical division of the eighth nerve might relieve the symptoms of Meniere's disease, but the operation was never performed by him. In 1902, Krause proposed a similar procedure for the relief of tinnitus. On October 6, 1908, following a discussion with Charles K. Mills concerning the propriety of dividing the auditory nerve intracranially for the relief of aural vertigo, Frazier sectioned the left eighth nerve in a patient with symptoms that are not in accord with the present-day concept of Meniere's syndrome. Partial relief was obtained. In 1913, Frazier reported the results of a second case in which the left auditory nerve was sectioned intracranially for tinnitus apparently resulting from trauma. There the matter stood until Dandy's report in 1928. Between September, 1924, and January, 1928, nine patients with Meniere's syndrome were operated upon by him. Eight were completely and one partially relieved following total section of the auditory nerve intracranially. In 1933, a second paper by Dandy regarding the surgical treatment of Meniere's syndrome indicated success in thirty cases. McKenzie (1932) reported two cases of intractable vertigo treated by the intracranial division of the vestibular portion of the auditory nerve. The first of these two patients was operated upon in 1931. Relief of symptoms was obtained in both instances. Additional communications of Dandy indicated the use of the subtotal section operation and the employment of this procedure bilaterally with successful results. Recent reports by Adson, Coleman and Munro indicate the general adoption of the idea of section of the auditory nerve for Meniere's disease.

In 1920, Sicard and Robinson recorded their observations in a case of "algie velopharyngée essentielle" treated by avulsion of the glossopharyngeal nerve extracranially. In 1924, Adson reported his experience with four cases of glossopharyngeal neuralgia, two of which were treated by an extracranial division of the nerve. In the same article he advocated an intracranial operation for this disorder illustrated with drawings of the proposed procedure. Fay (1926) reported the intracranial section of the ninth cranial nerve in conjunction with division of the upper cervical spinal nerves for pain resulting from carcinoma of the throat. On April 6, 1927, Dandy performed the first intracranial section of the ninth cranial nerve for glossopharyngeal neuralgia. That paroxysmal pain referred to the throat and the region of the external auditory canal may be relieved by section of this nerve on the affected side, seems to be established. It has been recorded that syndromes closely allied to those designated as glossopharyngeal neuralgia have not been relieved by this procedure. The work of Bucy (1936) and the unpublished work of Tarlov seem to indicate that intracranial section of the cephalad third of the vagal fibers at the medulla is indicated for the relief of pain referred to the inferior pharynx and laryngeal areas.

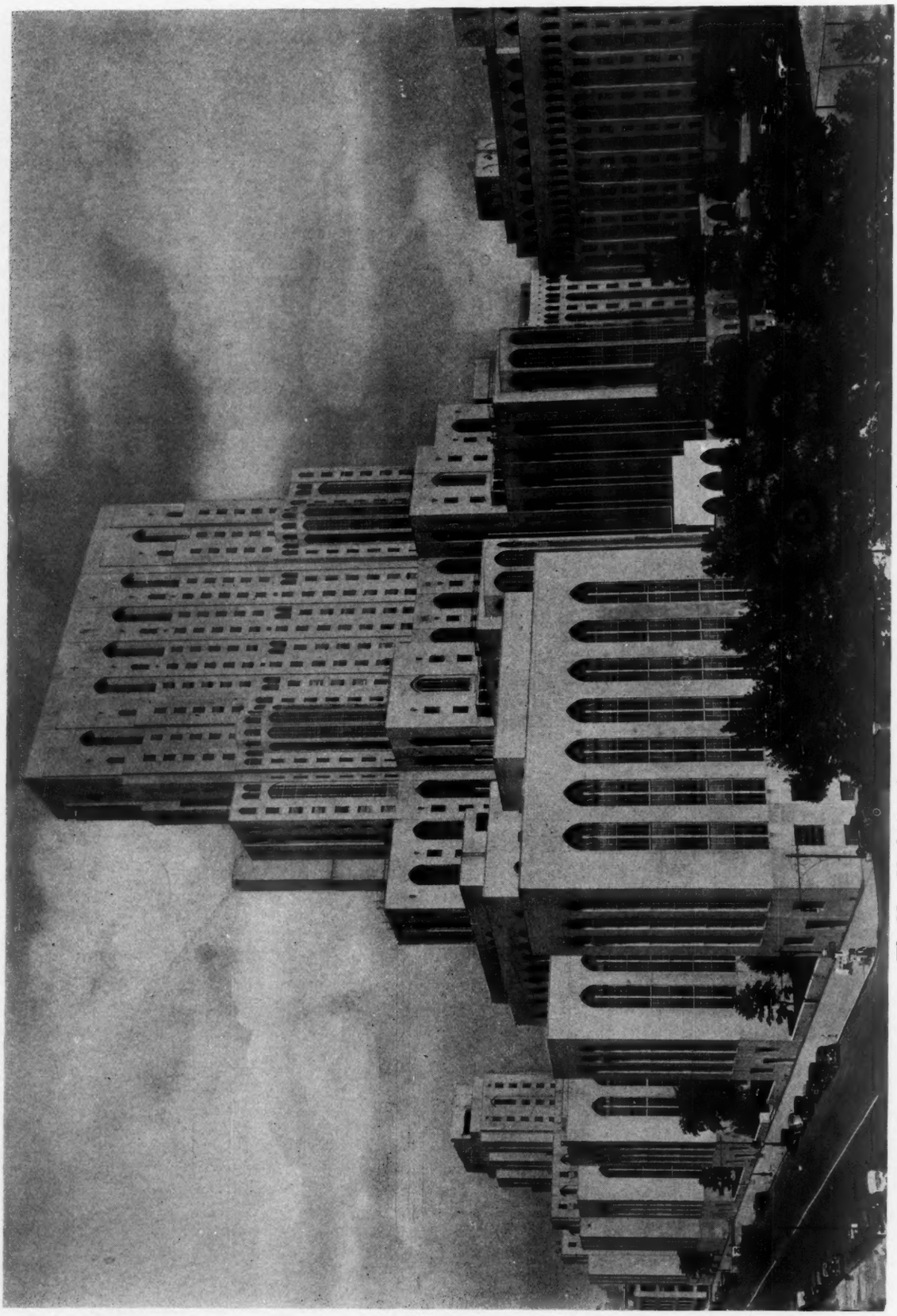
Spasmodic torticollis has captured the attention of several investigators, the first available record of an operation being performed for this disorder is that of Keen (1891). The eleventh cranial nerve and the posterior roots of the first, second, and third cervical spinal nerves were divided. In 1893, Gardner and Giles claimed priority of three months over Keen for this operation but their work was not published until two years after Keen's article appeared. McKenzie (1924) reported the results of an intradural division of the spinal accessory nerve and the sensory and motor division of first, second, and third cervical nerves on the same side. (The operation was performed by Cushing.) Finney and Hughson (1925) reported on the extraspinal division of the upper cervical nerves together with the spinal accessory nerves for the treatment of torticollis. Dandy, in 1930, also reported his results in eight cases using the intradural approach for the division of the upper three cervical spinal roots on the affected side and the cutting of the spinal accessory nerve peripherally.

TRAUMA OF THE NERVOUS SYSTEM

The many manifestations of traumatic insults to the nervous system have attracted the attention of surgeons since ancient times as indicated by the writings in the earliest available literature. Among the first to investigate the problem of brain trauma, at least from the viewpoint of altered physiology, was Duret (1874, 1877 and 1878) and von Bergmann (1880). After the Listerian period, trephination was resorted to more frequently in the treatment of a great variety of cranial and intracranial lesions of traumatic origin. In 1886, the symptoms and signs of extradural hematoma were analyzed by Jacobson. Ball and Schneider (1888) reported the successful removal of an intracerebral clot formed in the tract of a knife wound. Championniere (1890) and Michaux (1890) recorded operative procedures for the removal of spontaneous cerebral blood clots. It was in 1857 that Virchow published a paper on pachymeningitis hemorrhagica interna, giving the first clear account of the membranes surrounding what has come to be known as chronic subdural hematoma. He also recognized the hydroma variation of this disorder. It is not clear just when operations were first performed for the removal of these surface clots. It is possible that the earliest trephinations may have disclosed collections of fluid blood in the subdural space in those instances in which the dura was either intentionally or inadvertently opened. In any event, Macewen (1889) read a paper before the British Medical Association in which he described three cases of blood clots removed "from the surface of the brain." Starr, writing in



The First New York Hospital Erected in 1775



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1893, stated that between "the time of Macewen and the present" about thirty cases had been reported of successful removal of intracranial blood clots. The literature indicates that during the last decade of the nineteenth century surgical therapy for intracranial lesions of traumatic origin was for the most part restricted to compound fractures of the skull and intracranial hemorrhages.

At the turn of the present century the experimental work of Kocher and Cushing (1901, 1903) and the perfection of the decompression operation (Cushing) mark the beginning of a twenty year period during which there was a quite general adoption of the operative treatment of skull and brain injuries. The published reports relative to the subject are too numerous to mention. The ineffectiveness of the decompression operation in the treatment of many types of brain trauma became more evident when this method of treatment was carried out on a large scale during World War I. Weed and McKibben (1919) reported that intracranial pressure could be influenced by altering the osmotic pressure of the blood through the intravenous introduction of hypertonic and hypotonic solutions. Then followed a period of nonoperative treatment of patients with brain injuries, hypertonic solutions of dextrose, sucrose, and sodium chloride being used intravenously in an attempt to reduce increased intracranial tension resulting from trauma. Several articles have appeared presenting evidence in support of the nonoperative treatment of brain trauma and others, questioning the advisability of continuing the use of these hypertonic solutions as is now so popular. The general application of the nonoperative treatment of head injuries has tended to retard the acceptance of certain advances made in the operative therapy as applied to subdural hematoma in particular. Naffziger (1924) reported on subdural hydroma and in 1925 the excellent article by Putnam and Cushing concerning chronic subdural hematoma appeared. It is to Munro (1934, 1936, 1938) that the credit belongs for a careful analysis of the symptoms, signs and treatment of the different subdural lesions of traumatic origin that may result from trauma to the head. Peet and Kahn's review (1934) of the subject pertaining to the occurrence of the lesion in children produced a renewed interest in the treatment of subdural collections resulting from birth injury. Munro's recent book (1938) and that of Brock (1940) summarize the present state of our knowledge relative to the subject of brain trauma.

Operations on the spine for fracture are not of recent origin. In the seventh century, Paul of Aegina, recommended incision of the soft parts and removal of fractured laminae. Ambrose Paré and his contemporaries operated for fracture of the spine. In 1850, Brown-Sequard described the syndrome that we now designate by his name. During the latter half of the nineteenth century there were recorded many descriptions of the findings, both clinical and pathological, following injury of the spinal cord at various levels. Laminectomy was rather frequently resorted to as a therapeutic measure particularly after the Listerian period. The idea of operating for fracture of a vertebra was carried over into the present day, and in 1916, Elsberg, in a monograph on the "Diagnosis and Treatment of Surgical Diseases of the Spinal Cord and its Membranes," stated that he advised operation in instances of incomplete physiological interruption of the spinal cord resulting from trauma. Lumbar puncture to determine the presence or absence of blood was also suggested. The work of Head and his associates during the last World War deserves special mention. For the next decade little was added to our knowledge apart from pathological descriptions of the lesions to be found at operation or autopsy, such as was published by Thomson in 1923. Then in 1925 Coleman advocated the use of the Queckenstedt test for determination of the presence or absence of spinal cord compression. Slowly a conservative attitude was adopted and as

Coleman suggested, only those cases showing evidence of partial or complete block of the spinal subarachnoid space were subjected to laminectomy. Today there is little that can be added to this, save for the gradual realization that in instances of fracture-dislocation of the cervical vertebrae with associated spinal cord injury, operation is seldom of benefit regardless of the patency of the spinal subarachnoid space. A significant advance in the conservative treatment of patients suffering from fracture-dislocation of the cervical vertebrae with associated spinal cord injury has been the use of tongs advocated by Crutchfield in 1933 (suggested by Coleman in 1932), as a means of applying skeletal traction. The application of the work of Holmes (1935) and of Denny-Brown and Robertson (1933) relative to urinary bladder paralysis has been advantageous in those cases of bladder dysfunction resulting from spinal cord injuries as has also been the institution of tidal drainage as advocated by Munro and Hahn (1935).

It is not clear just when the first end-to-end anastomosis was performed upon peripheral nerves. The tenet of immediate suture of divided nerves, now so generally accepted, was not universally understood in 1890 when neurosurgery stood on the threshold of a rapid development. Cantile, lecturing before students in 1889 said that in simple division of a nerve, as in traumatic severence, it was not necessary to suture the divided ends, but that merely placing the parts at rest would allow union of the nerves. Duncan, on the other hand, in 1892, cited the excellent outcome of two cases of immediate suture of divided peripheral nerves, and emphasized the importance of immediate surgical interference. Elaborations upon the simple end-to-end procedure are not of recent origin. Letievant, in 1872, described the so-called flap method of suturing nerves in which there was a gap to be bridged. The method has proved unsatisfactory and is seldom used today. Suture *á distance* was originated by Assaky in 1886, designed to provide a guiding framework of catgut for the downgrowing axones. The method of nerve implantation, that is, implanting a peripheral segment of the divided nerve into an adjacent healthy nerve trunk, was proposed by Letievant in 1873 and adopted clinically by Despres three years later. Sick and Sanger, in 1897, reported the first successful case using this procedure.

According to Stookey the first nerve graft in human surgery was performed by Albert in 1878. Huber (1895) reviewed cases recorded in the literature in which this method had been employed. Schuller was the first to point out the possibility of gaining additional length in divided nerve segments by the process of stretching. During World War I the value of direct end-to-end suture performed immediately, or as soon as possible after the division of a nerve, was recognized as the best method. The experience of many with large numbers of cases during this period led to the publication of several noteworthy articles describing the various phases of this branch of surgery. Head's "human experiment" was accorded considerable prominence (1920). Among the more important recent contributions on this subject is the monograph of Pollack and Davis (1932).

PYOGENIC INFECTIONS

No doubt inflammatory diseases of the central nervous system, especially meningitis and brain abscess were known and treated by trephination during the pre-Christian era. Occasional scanty reference may be found concerning these infections particularly in association with fractures of the skull. In 1665, Peter de Marchettis wrote, "I remember having a consultation with the famous D. Julio Sala, professor at Pavia, about a man who had been wounded in the head with a dagger. Not only was the bone injured, but the membranes and even the brain. The external wound had been treated by a certain practitioner and a cicatrix had formed. After two or three months the patient was troubled with

epilepsy and had a fit twice or three times a month. When asked by Professor Sala whether he had ever had an injury to the head, he replied that he had, and pointed out the place. I immediately inserted a probe beneath the crust, and found a penetrating wound, and proceeded at once to open the parts. The next day I applied the trephine; yellow pus escaped. For twenty days I applied over the brain black western balsam, with the use of which the wound granulated, and in thirty days the patient was cured of his wound and of his epilepsy."

During the first half of the nineteenth century several reports indicate an interest in cerebral abscesses. Considerable information concerning cerebral localization was derived from the earlier encounters with such infections of the brain. Broca was the first to trephine (1861) for abscess of the brain diagnosed by the then new theory of cerebral localization. The pathological description of abscess of the brain, preceded the systematic operative intervention for the treatment of the disease. Hooper, (1826) published a beautiful illustration of encysted abscess and spreading suppuration of the brain. Cruveilhier published a picture of a temporosphenoidal abscess in 1835, and Bright of the same type of lesion in 1831, including an illustration of the temporal bone disease from which it presumably arose. Auvert, in 1851, gave the first illustration to be found in the literature of cerebellar abscess. The first full and critical account of brain abscess was published by Lebert in 1856 and was based on the records of eighty cases. In 1887, Schwartz successfully operated on a cerebellar abscess. To Macewen goes the credit for the major literary contribution in this field. His book, "Pyogenic Infective Diseases of the Brain," (1893) was perhaps his outstanding contribution to craniocerebral surgery. His recorded successes in the treatment of brain abscess matches if not surpasses many of the present day therapeutic attempts. For the treatment of brain abscesses he advised that a decalcified femur of a chicken be used as a drain.

Aside from this method of Macewens, most measures employed surgically were those of trephination and drainage by means of wicks, and the frequent consequence was cerebral fungus, meningitis and death. It appears that little advance was made in the treatment of brain abscess until Mosher, in 1916, began his experiments with drainage material and evolved a copper wire "basket" which has come to be known as the Mosher drain. In 1925, Cahill reported twelve cases of cerebral and cerebellar abscesses treated by this method without a fatality. Adson (1920) recorded his results following utilization of an osteoplastic flap with drainage through an opening in the base of the flap. In 1924, King described a method of therapy accomplished by the creation of a rather large cranial defect directly over the abscess cavity and complete unroofing of the cavity thus permitting the lesion to herniate. King's method ran counter to the then accepted method of attempting to prevent herniation. In 1926, Dandy advocated "tapping" of the abscess thereby eliminating continuous drainage. This method of treatment has not been generally adopted. Horrax, in 1934, described a procedure, first suggested by Cushing some ten or twelve years earlier, for chronic encapsulated abscesses. This he termed "marsupialization of the abscess." In 1935, Adson and Craig reported a procedure somewhat similar to that used by Horrax. In 1936, King recommended the unroofing of the abscess cavity, the careful inspection of its interior and packing the abscess with a "handkerchief" of iodoform gauze. Repeated irrigation was carried out and herniation controlled by lumbar punctures. Several surgeons have recorded instances of complete extirpation of chronic abscesses, however, the indications for this method of treatment are not frequent. The part that chemotherapy may play in the treatment of brain abscess cannot be evaluated at the present time.

That the disease, spinal epidural abscess, was known over a century ago is indicated by the early reports on this subject by Bergemeschi in 1820, Albers in 1833, and by Bristowe in 1855. Donati (1906) and Schmalz (1925) presented excellent summaries of the situation. The view that these spinal infections may be secondary to an osteomyelitis of the vertebra was first proposed by Ramsey Hunt in 1904. The treatment, laminectomy, with wide exposure and drainage of the abscess seems to be accepted. That the clinical entity is gaining recognition is indicated by the recent articles of Slaughter, Fremont-Smith and Munro (1934) and Cohen (1938) who report cases of spinal epidural abscess correctly diagnosed and operated upon before the appearance of neurological symptoms or signs.

SURGERY OF THE SYMPATHETIC NERVOUS SYSTEM

As has been said regarding the development of the surgery of the central nervous system, there are a few investigators whose anatomical and physiological observations have been the foundation stones for a proper understanding of the sympathetic nervous system. Outstanding among these are the contributions of Winslow (1732), Neubauer (1772), John Hunter (1776), Bichat (1802), Von Kölliker (1852) and Claude Bernard (1878). Alexander (1889) has been credited with the performance of the first operation on the sympathetic nervous system. This was a cervical sympathectomy for epilepsy. In 1896, Jonnesco recorded the results in a group of epileptics treated by this method. In 1899, Jaboulay resected the lower cervical sympathetic chain for exophthalmic goiter. There the matter rested until 1913 when Leriche called attention to the effect of periarterial sympathectomy on the circulation in the extremities. Further attention was attracted to this field when Jonnesco (1916) on the basis of the work of Francois-Franck, performed the first successful operation on the sympathetic system, removal of the stellate ganglion for angina pectoris. Then followed the work by Hunter and Royle (1924) ramisectomy for spastic paralysis and their personal presentation of the subject in the United States which truly marks the beginning of a wide-spread interest in the possibility of operating on the sympathetic system for a variety of disorders. Although the results in those cases for which the operation of Hunter and Royle was proposed were not enduring, as a by-product the operation of Wade (1927) for congenital megacolon and several procedures for the treatment of peripheral vascular diseases were evolved. The technical modifications of the original Wade operation have been many, the important ones in this country having emanated from Adson and his coworkers.

The first operation for the relief of symptoms resulting from vasospasm or the commonest cause of this disorder, Raynaud's disease, was performed by Veillet and Thibaudet in 1918. The work was extended by Bruning and Stahl in particular. Leriche contributed generously toward advancement of this form of treatment, however, in the main, periarterial sympathectomy was employed as a procedure of choice. The stellate ganglion had been surgically approached through the anterior cervical incision until it was proposed by Henry (1922) that the sympathetic trunk at this site would be more adequately exposed by a dorsal route. This idea was put into practice by Adson for the first time in 1928. Royle (1928) reported his operation for the treatment of Raynaud's disease. Improvement in technical features and the results following different operative procedures have been recorded by Adson, Gask, Leriche, White and others. In 1938, Smithwick presented a new operation to replace the cervicodorsal sympathetic ganglionectomy. Following this procedure the undesirable effects of section of the postganglionic fibers to the upper extremities were avoided and the relief of symptoms of Raynaud's disease were enduring.

After Jonnesco's report in 1920 on the surgical treatment of angina pectoris, a great variety of operations on the cervical sympathetic system were devised and carried out. In 1925, Reid and Andrus, reviewing the subject, were able to find fifty cases of angina pectoris treated by operations on the sympathetic nervous system. They listed the procedures employed up to that time: (1) excision of the lower cervical and first thoracic ganglia and the intervening cord; (2) excision of the entire cervical chain including the stellate ganglion; (3) division of the cervical sympathetic trunk and the superior cardiac nerve; (4) excision of the superior cervical ganglion; (5) excision of the middle cervical ganglion; (6) removal of the superior and middle cervical ganglia and intervening trunk; (7) excision of the middle and inferior cervical ganglia and sympathetic cord; (8) extirpation of all cervical ganglia and the sympathetic cord; (9) resection of the depressor nerve; (10) resection of the dorsal root of the second left thoracic nerve; (11) indefinite procedures. They concluded that the operation which had been most successful was removal of the stellate ganglion and all or a major part of the cervical trunk.

During the past fifteen years many contributions to the subject have appeared in the literature including chapters in several monographs, the outstanding one dealing with surgery on the sympathetic nervous system being that by White (1935). Following the introduction of paravertebral alcohol injection for the relief of pain of cardiac and aortic origin by Mandl (1925) and by Swetlow (1926) operative procedures have not been so frequently advocated. This method of treatment has been greatly amplified by the work of White.

In 1889, Bradford published observations to the effect that stimulation of the anterior roots of the spinal nerves, from the sixth thoracic to the second lumbar, caused a rise in blood pressure and contraction of the kidney. The greatest reaction was obtained by stimulation of the spinal roots of the ninth thoracic to the second lumbar spinal nerves inclusive. In 1923, Bruning suggested sympathectomy for control of arterial hypertension, and the same year Daniélopolu suggested operation on the splanchnic nerves for this condition. Two years later Rowntree and Adson reported a case of malignant hypertension treated by bilateral lumbar sympathetic ganglionectomy. Section of the splanchnic nerves for arterial hypertension was first performed by Pieri in May 1930, but this operation was limited to one side. In 1934, Craig cut the splanchnic nerves through a subdiaphragmatic approach, and in 1935 Peet published a report on bilateral splanchnic nerve section as carried out in over sixty patients with favorable results in a large proportion of the cases. In 1934, Adson and then Heuer sectioned the anterior spinal nerve roots from the sixth thoracic to and including the second lumbar root in an attempt to reduce excessive arterial tension. Crile advocated the treatment of hypertension by excision of the celiac ganglion and denervation of the aortic plexus. Many workers have been attracted to this field of surgical endeavor and in general the results have at least matched and in some cases bettered those obtained by the conservative methods of therapy, but a satisfactory and generally applicable means of dealing with this disorder remains to be devised.

In addition to these surgical procedures that have been quite generally adopted, operations upon the sympathetic system have been devised for a great variety of disorders. Ganglionectomy for hyperhidrosis, Kotzareff (1921), Braenker (1928), Adson (1932); sympathectomy for thromboangiitis obliterans, Diez (1931); Adson (1932); cervical ganglionectomy, Dandy (1931) for hemicrania; relief of certain types of abdominal pain by ramisectomy, Scrimger (1929); cervical sympathectomy for atypical facial neuralgia, Frazier (1928), Fay (1932); facial paralysis, Leriche (1926), etc.

Jaboulay made the first attempt to relieve pelvic pain by dividing pelvic sympathetic

nerves through a retrorectal approach, (1899). Ruggi, in 1899, advocated resection of the utero-ovarian plexus by way of a transperitoneal route. Leriche (1921 and 1925) introduced periarterial sympathectomy of the internal iliac arteries for dysmenorrhea, and in 1925 Cotte described resection of the superior hypogastric plexus (termed by Latarjet and Bonnet the presacral nerve). Herman is said to have been the first American surgeon to perform this operation. Since then Adson and Masson, Greenhill and Schmitz, Counseller and Craig, Abbott, White, Wetherell, DeCourcy, Keen and others have recorded favorable results obtained by resection of the presacral nerve in cases of intractable pelvic pain from disease of the urinary bladder, uterus, rectum and other pathological and pathophysiological states of this anatomical region. The operation of presacral neurectomy has been advocated for the relief of obstipation associated with Hirschsprung's disease, but the production of sterility by the procedure has militated against its use in this condition.

MISCELLANEOUS

The arteries of the intracranial cavity may undergo pathological changes that result in aneurysmal formations at many sites, however, the saccular aneurysms of the intracranial portion of the internal carotid artery, the fistulous aneurysms of the carotid-cavernous type, and the small saccular aneurysms arising from the circle of Willis have been attacked by the surgeon. In addition may be mentioned the congenital arterial, arteriovenous and venous malformations of the blood vessels of the brain itself. For the treatment of all these conditions extracranial ligation of the internal carotid artery or ligation of the common carotid has been practiced. In many instances the carotid ligation was carried out without a more critical study or knowledge of the situation being made than that afforded by physical examination. It appears that Benjamin Travers (1809) was the first to perform ligation of the carotid artery for pulsating exophthalmos. The operation of carotid ligation for many conditions, trigeminal neuralgia, epilepsy, the pyschoses, etc., was practised during the first half of the nineteenth century. Pilz (1868) published a paper on ligation of the common carotid artery based on six hundred cases with a total mortality of 43 per cent. Numerous reports have appeared regarding the use of carotid ligation for vascular tumors of the scalp as well as for pulsating exophthalmos. It is within recent years that the principle of proximal arterial ligation has been applied to the group of saccular intracranial aneurysms. Several such lesions have been exposed by intracranial exploratory operations and the carotid artery ligated proximal to the lesion at a later date. The introduction of cerebral angiography by Moniz (1927) placed the final diagnostic procedure for these lesions of the blood vessels in the hands of the surgeon and as a consequence the operation of carotid ligation for saccular intracranial aneurysms is being more widely employed. Hamby and Gardner (1933) practiced both proximal and distal ligation of the fistulous aneurysms of the carotid-cavernous type. Dandy (1935) suggested the use of clips to close the internal carotid artery distal to the aneurysm following a previous extracranial ligation of the artery proximal to the lesion. Dott (1933) applied fascial strips about a small saccular aneurysm of the circle of Willis. Dandy (1938) carried out both proximal and distal ligation for saccular aneurysm of the intracranial portion of the internal carotid artery.

It would seem from a comparison of the writings that appeared some fifty years ago with the publications of today that many of the same etiological factors were assigned to convulsive disorders then as now. Furthermore, the reported results following surgical therapy are not very encouraging. There has been less advance in the treatment of "essential" epilepsy than any other condition with which the neurological surgeon is required to deal. It is difficult to trace the earliest writings on this subject.

It is probable that some of the trephine openings found in the skulls of the pre-Christian age were made to let out spirits which were blamed for inciting their host to fits. Aside from this speculation, there are well documented reports to be found in the writing of Starr whose book was published in 1893 concerning the operations for convulsive disorders, including a chapter devoted to epilepsy. The cases of traumatic origin were considered most favorable. If upon exposing the area of brain under suspicion no discernible lesion was found, faradic current was used to stimulate the cortex and the area responding to the minimal stimulus was considered a focus of origin for the fit and therefore excised. It was considered that from such a focus the extension of the fit occurred "like a ripple of a pond when a stone is thrown into it." The paralysis resulting from such an excision, for usually this would be in the vicinity of the motor area, gradually passed away, and in some cases the disease was cured. Laurient (1891) collected one hundred and two cases of trephination for epilepsy; 54 per cent were stated to have been cured. Agnew (1891) collected fifty-seven additional cases, although the results in this series were not as good. Starr included a detailed account of the gross pathological changes found at operation and careful histological studies of the excised cortex. Interesting records of the earlier experience with this disease reveal a boldness of attack by surgeons who are frequently considered, by the uninformed of today, to have been hopelessly unfamiliar with such problems. The enormous literature that has accumulated regarding the diagnosis and treatment of patients with recurring convulsive seizures indicates an attitude of perseverance unparalleled in any other problem confronting the surgeon. Much has been accomplished in that many lesions of a gross organic nature are identifiable by Dandy's method of cerebral aerography. The etiology of so-called cerebral dysrhythmia appears to be as obscure today as it was fifty years ago. In more recent years Foerster in Germany and Penfield in Canada have worked on this problem, perhaps more than others. Recently Berger's (1929) electroencephalographic method has given impetus to further study; however, this diagnostic procedure has not as yet given the indications for effective therapy.

The experimental work of Dandy (1913, 1917, 1919) together with the work of Weed, laid the foundation for the present-day concepts of the mechanisms of the production of hydrocephalus. In addition to this, Dandy has, in a series of papers, described means for extirpating the choroid plexuses of the lateral ventricles (1918, 1922) and of the fourth ventricle (1938) and described operative attack on the problem of stenosis of the aqueduct of Sylvius (1920) and an operation (1921) designed to provide access for fluid into the general spinal subarachnoid circulation that has been retained within the ventricular system through occlusion of the foramina of Magendie and Lusckha. Putman (1934) reported his results following electrocoagulation for essential hydrocephalus.

Operation for the various malformations of the spinal cord and its coverings occupied a prominent place in the writings of fifty years ago (Von Bergmann 1889). Several minor innovations have been introduced during the last half century concerning the surgical treatment of these lesions. Penfield and Cone advocated infolding instead of extirpating the involved meninges. There is still much to be desired in the surgical treatment of the congenital disorders of both the intracranial and the intraspinous structures.

Another advance in surgery for the relief of intractable pain was made when Spiller advised section of the anterolateral columns of the spinal cord. And thus it was that on January 19, 1911, Martin carried into practice the idea of his confrere and performed the first cordotomy through a laminectomy of the sixth, seventh and eighth dorsal vertebrae. The patient was

a poor witness and the results of the procedure were admittedly difficult to evaluate, but Spiller and Martin were satisfied that at least a considerable if not total alleviation of the pain had been effected. The procedure is advocated by many surgeons, however, it seems that the operation has only a limited applicability.

In 1920, Hassin stated that he had seen Meyer perform an operation for syringomyelia but the outcome of the procedure was not mentioned. Considerable space was devoted to this subject in the Oxford Loose Leaf Medicine by Collier the following year and in 1926, Pousepp was the first to report on the results of the procedure. Rare articles have appeared concerning the cure of this malady by incision into the cavities of the cord with release of the encysted fluid, and in 1930, Frazier, and in 1931, Putnam, published further observations following this operation.

The discovery by Bell and Magendie respectively, about a century ago, of the function of the anterior and posterior roots, laid the foundation for attempts to interrupt the latter in painful afflictions. Such a suggestion was first made in this country by Dana and in England by Bennett. The first rhizotomy was performed by Bennett (December 24, 1888) with section of the left lumbar and the first and second sacral posterior spinal roots intradurally, but unfortunately the patient died on the twelfth postoperative day. The relief from pain had been complete from shortly after operation until death. The second rhizotomy was carried out by Abbe (December 31, 1888). The sixth and seventh cervical spinal nerves on the right side were cut extradurally in a forty-four year old man suffering from violent pain and spasmodic movements in stump of the right arm, the result of amputation. For two years after Abbe's operation the patient was well and abandoned the morphia habit, but four years following operation pain in the stump recurred and a drawing sensation was referred to the fingers although the area of cutaneous anesthesia remained unaltered. Foerster has had extensive experience with rhizotomies and as a by-product of his work we have a record of carefully charted resultant sensory loss, following root section of all spinal levels. Foerster and Schuller were probably the first to suggest posterior rhizotomies for certain spastic conditions and it was following such operations that observations were made relative to the increased skin temperatures in the denervated area. From this came the idea of posterior root section designed to improve the blood flow in extremities.

Horsley (1909) described an operation for the relief of the slow vermicular movements commonly termed athetosis. According to Putnam (1939) success with Horsley's operation had been reported by Anschutz, Payt, Mazaroff and Sachs. In 1931, Putnam recorded the results following cordotomy in the cervical region for unilateral and generalized athetosis. Bucy and Buchanan (1932) and Bucy and Case (1937) reported on the effect of extirpation of area six (Brodmann) in instances of athetosis.

Following the observation by Fulton and Jacobsen in 1935 that primates in whom a bilateral prefrontal lobectomy had been performed were not easily made neurotic by the presentation of problems difficult of solution and the report by Brickner and Ackerly in 1934 that a considerable portion of the prefrontal areas may be removed in man (they studied a lobectomized human) without lowering of the general intellectual level, Moniz performed prefrontal lobotomies in patients with psychoses. A paper published in 1936 indicated that this operation had been performed by him in twenty cases and that good results were obtained in those suffering from agitated depression psychosis. Freeman and Watts in this country recorded a case shortly after the paper of Moniz appeared. In this communication they state that Moniz had performed the operation on twenty additional patients. Subsequently, Freeman and Watts published a report on the

operation after experiences with forty-eight cases (1939). The possibility of altering pathological, physiological or abnormal psychological states by dividing seemingly normal structures of the nervous system has attracted the attention of a few surgeons within recent years and bids fair to open a new approach to several problems heretofore not considered amenable to surgical therapy.

Any historical account, however deficient, which carries the reader up to the present day, could logically include a prediction for the future. This I refuse to attempt although it may be said that the horizon for further advances in neurological surgery appears boundless. Especially in America where internal strife and periodic wars have not diverted the attention of men capable of deductive synthesis, there should be a constant increase in the flowering of productive thought. The safeguard for the years to come is the retention of students of an intellectual order that will permit ingraftment of the knowledge already attained and the inculcation of a desire to devote a substantial portion of their time to scientific investigation.

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FIFTY YEARS OF OPHTHALMOLOGY IN THE UNITED STATES*

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DURING the past fifty years, definite advances have been made in surgical technic, in diagnosis, and in immunologic, chemotherapeutic and orthoptic treatment as well as in other therapeutic measures to combat eye diseases; yet modern ophthalmologists could learn much from the older practitioners concerning the practice of medicine. In spite of excellent contributions by Derby,[1] Riggs and Lunt,[2] Rutherford[3] and others, more consideration should be given to the psychology of patients and particularly the mental disturbances which almost invariably accompany ocular disease. This subject first received active consideration in 1913, when psychoanalysis began to stress the symbolic significance of the eye: Dunbar[4] has published a large number of abstracts from articles on psychic factors in eye affections. Mental disturbances after operations on the eye have been described by Posey.[5] Posey, de Schweinitz and Holloway added greatly to modern knowledge of neuro-ophthalmology; Posey collaborated with Spiller in writing a textbook on neurology of the eye.

Posey also contributed to our knowledge of the hygiene of the eye and was associated with the remarkable progress made in preventing blindness. Park Lewis and Howe pioneered in the movement to conserve vision through the prevention of accidents, ophthalmia neonatorum and other diseases, improved methods of treatment, better understanding of hereditary defects and especially through the education of the public by the organization of the National Society for the Prevention of Blindness. Sight-saving classes for the visually handicapped have been developed in the United States during the last few years, mainly through the work of Winifred Hathaway, and the development of social service in ophthalmology has made marked progress in the last few years largely due to studies on this subject contributed by Derby.[6]

Great impetus has been given to the improvement of the teaching of ophthalmology through the development of examinations for the certificate of the American Board of Ophthalmology. This Board which was the first of the surgical specialty boards, was originally suggested by Dr. Edward Jackson. He was aided in the organization work in 1915 by the following committee: Walter B. Lancaster, Wendell Reber, Frank C. Todd, Edward C. Ellett, Hiram Woods, Myles Standish, William H. Wilder and Alexander Duane. Judd Beach, the historian of the Board, has compiled a history of ophthalmology for the years 1908 to 1915. During these years the foundation of the Board was laid. Since that time ophthalmology has made many advances not only in teaching but also in regulating requirements for the preliminary training of ophthalmologists. Moreover, educational standards for ophthalmologists[7] have been gradually raised.

Clinic practice, which is so important in preventing blindness, has improved and standards for out-patient service in ophthalmology[8] have been prepared by the Committee on Standards for Out-Patient Service in Ophthalmology of the New York Academy of Medicine. These standards illustrate modern trends in ophthalmic examinations and recommend standard equipment for eye clinics. The standardization of the preparation of drugs employed in ophthalmology has been studied by

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Hasler.[9] His method consists in preserving eye solutions by the addition of nipaginnipasol, which is nontoxic to man, nonirritating to the eye and sterilizes and prevents contamination of eye solutions.

Development of research in ophthalmology has progressed rapidly during the last fifty years with the establishment of several foundations and institutions devoted to research. The first institutions actually performing organized research were: the Wilmer Institute, Washington University (St. Louis), Howe Laboratory at Cambridge and the Presbyterian Institute of Ophthalmology. Among the foundations, the Wilmer, Knapp, Markle, Schnyder and Ophthalmological, have done and will do much to advance the science of ophthalmology and prevent blindness. The Wilmer Institute under Wilmer and Woods, the Presbyterian Institute of Ophthalmology under Wheeler, Dunnington and Thygeson, the Howe Laboratory under Verhoeff and several departments of ophthalmology, as that at Washington University under Post, another at the University of Iowa under O'Brien, the Department of Research at the Brooklyn Eye and Ear Hospital under Evans and the Research Department of the New York Eye and Ear Infirmary are in a position to contribute. The Dartmouth Eye Institute founded by Ames in 1919 has made notable contributions especially in the field of binocular vision and space perception. Several institutions are developing departments of research similar to that under Adler at the University of Pennsylvania. The American Academy of Ophthalmology and Otolaryngology, the Section on Ophthalmology of the American Medical Association and the American Ophthalmological Society have cooperated in promoting research and in considering many ophthalmologic problems.

The Association for Research in Ophthalmology was organized in 1930. Its first president was William H. Wilmer, and its first secretary, Eugene M. Blake. The early meetings of the Association were devoted to the study of uveal infections.

Among the oldest eye institutions in America which have contributed greatly to the development of ophthalmology are the New York Eye and Ear Infirmary (founded in 1820), Brooklyn Eye and Ear Hospital (1868), the Manhattan Eye, Ear and Throat Hospital (1869), the Hermann Knapp Memorial Hospital (1869) and the Massachusetts Charitable Eye and Ear Infirmary (1899). In 1935, the Section on Ophthalmology of the New York Academy of Medicine was 50 years old.

FOCAL INFECTIONS

Focal infections in relation to inflammatory diseases of the eye have assumed increased importance since Billings' original contribution in 1912.[10] The importance of gastrointestinal intoxication, teeth, paranasal sinuses, prostate, gallbladder and pelvic organs in the pathogenesis of chronic uveitis was stressed by de Schweinitz in 1913.[11] In 1916, Frank Billings[12] published his classic lecture on focal infections.

Elective localization in the eye of bacteria from infected teeth was discussed by Meiser and Gardner[13] in 1922 and Haden[14] in 1923. In 1932, Rosenow and Nickel[15] discussed elective localization in determining the etiology of chronic uveitis. In the study of focal infection some progress has been made in differentiating bacteria by in vitro tests.[16] The study of ocular infections in brucellosis (undulant fever) has received increased incentive through the work of Green.[17]

Immunologic factors in infections of the eyes have been investigated by numerous workers. Woods has made a number of valuable studies on ocular anaphylaxis. His book on "Allergy and Immunity in Ophthalmology" is an outstanding contribution. In 1917,[18] he studied Elschnig's theory of allergy and described a treatment which consists in desensitization with uveal pigment until immunity is produced. In 1927, Woods and Burky[19] described the preparation and immunologic and chemical

properties of lens protein and its fractions. In 1933, Woods and Little[20] published an article on the hypersensitivity and therapeusis of uveal pigment.

UVEAL TRACT

Valuable contributions to our knowledge of the etiology of iritis have been made by Irons and Brown.[21] These workers in association with Nadler[22] studied experimental iridocyclitis in rabbits and investigated the localization of streptococci in the eye. Iritis has been produced experimentally in rabbits' eyes by the intracutaneous sensitization and intravenous intoxication with living streptococci by MacLean.[23] Seegal, Seegal and Khorazo[24] demonstrated that if a nonspecific inflammation is produced in the eyes of experimental animals or if the eyes are traumatized while an antigen is circulating in the blood stream, the antigen is absorbed directly in the eye and produces ocular sensitization.

The bacteriologic and immunologic considerations of chronic uveitis have been studied by Brown[25] who showed that ocular sensitivity from a remote infected agar implant may occur on the third day.

The role of intraocular typhoid antibody content in the treatment of uveitis has also been studied by Brown.[26]

CHOROID

Sympathetic Ophthalmitis. Much thought has been given to sympathetic ophthalmitis; in 1919 Knapp[27] discussed the autotoxic factor. The theory of a virus as the cause of sympathetic ophthalmitis was advanced by Gifford and Lucic.[28] Sensitization to uveal pigment in the etiology of sympathetic ophthalmitis and the use of uveal pigment in the diagnosis and treatment of this disease has been discussed by Alan Woods.[29]

Adequate statistical data to evaluate the efficacy of massive doses of diphtheria antitoxin, as suggested by Verhoeff[30] for the treatment of sympathetic uveitis, are still not available. In 1934, Friedenwald[31] excised an area of skin injected with a test dose of uveal pigment. He found that in patients with sympathetic ophthalmitis, the skin excised fourteen days after injection showed marked cellular infiltration with round cells, epithelioid cells and giant cells, and almost complete phagocytosis of the injected pigment. In normal and insensitive individuals there was practically no cellular reaction and little phagocytosis of pigment.

Tumors. Knowledge concerning prognosis in tumors of the choroid has been enhanced by Callender and Wilder,[32] who have classified malignant ocular melanomas according to their argyrophil fiber content. The outstanding facts brought forth by this study are that no deaths have occurred from any spindle cell subtype A or fiber group 3 tumors and that the patients in all cases in which no argyrophil fibers appear among the tumor cells have died.

OPERATIONS ON THE IRIS

In 1891, Smith[33] described his modification of Critchett's operation of iridodesis for iridodialysis; the iris was drawn into a small peripheral wound. Modifications of this technic have been proposed by Jameson,[34] Key[35] and Bulson.[36]

Rones[37] has described the Wilmer iridocapsulectomy for occluded pupil.

GLAUCOMA

Pathogenesis. Friedenwald and Pierce[38] have experimentally studied the pathogenesis of acute glaucoma. The secondary fall in pressure, observed by these investigators in animals after the injection of histamine into the vitreous or anterior chamber, resembles the hypotensive stage which occurs in acute glaucoma relieved by miotics without operation.

Incipient Glaucoma. In a study of the effects of mydriatics upon intraocular tension Gradle[39] concluded that in persons past 30 years of age tonometric measurements made immediately before and directly after the use of a mydriatic or cycloplegic agent are of value in the diagnosis of incipient glaucoma.

Light Sense. Waite, Derby and Kirk[40] suggest that the light sense in early glaucoma is affected before there is any sustained increase in intraocular tension, any cupping of the disk or any visual field changes characteristic of glaucoma. This disturbance in light sense is characterized by: (1) a tardiness of dark adaptation, and (2) in the dark adapted eye, a dulling of sensitivity to dim light.

Medical Treatment. Numerous medical measures have been recommended for the treatment of glaucoma. The administration of adrenal cortex extract in glaucoma has been investigated by Woods[41] who does not advise its therapeutic use in glaucoma.

Surgery. New surgical technics for the treatment of glaucoma are numerous. Barkan[42] devised a method of opening Schlemm's canal by employing the binocular microscope for certain cases of chronic glaucoma. Schoenberg[43] has also recommended the use of a binocular microscope for delicate surgery of the eye.

Wootton, in 1932,[44] and Wheeler,[45] in 1936, devised technics which combined iridectomy with cyclodialysis for the reduction of ocular tension.

Verhoeff[46] advocated a button-hole iridectomy, midway between the pupil and the attached border; in this technic the upper border of the buttonhole is seized and drawn under the conjunctival flap, turning the pigmented surface forward and leaving the sphincter iridis within the eye.

Gifford[47] advises iridencleisis with water tight closure of the conjunctiva because of its effectiveness in reducing tension permanently in the large majority of cases. Its chief value is in chronic simple glaucoma and buphthalmos. Greenwood[48] believes that a well performed combination of iridencleisis and sclerectomy will almost invariably yield a good filtering cicatrix and usually without massage in chronic glaucoma.

Reese[49] described a conjunctival flap for glaucoma, using a broad keratome, while a pocket flap sclerecto-iridodialysis for glaucoma has been described by Spratt.[50]

After studying postoperative glaucoma, Fox[51] believes that the obstruction at the filtration angle is the ultimate cause of all postoperative glaucoma.

EYEBALL

Exophthalmos. Much valuable work on progressive exophthalmos has been done by Naffziger.[52] He has advised[53] the intracranial removal of the orbital plate and the roof of the optic foramen, and the opening of the ring of Zinn. It has recently been shown that space can be found for the excessive orbital contents by opening downward into the antrum instead of upward into the cranial cavity and with greater safety.

In pulsating exophthalmos, Dorrance[54] has ligated the common carotid and, after a week or two, all of its branches except the internal maxillary and the superficial temporal branches from the external carotid.

Enucleation and Evisceration. In 1900, Gifford[55] strongly advocated simple evisceration. Because the ball placed in the sclera in Mules' operation was extruded in many cases, Fox[56] tenotomized the four recti muscles immediately after the removal of the contents of the eyeball.

CONJUNCTIVA

Conjunctivitis. John E. Weeks[57] was the first to demonstrate that a small bacillus (usually known as the Koch-Weeks bacillus) was the etiologic factor in acute contagious conjunctivitis. Verhoeff[58] discovered the filamentous organism classified as leptothrix which causes Parinaud's conjunctivitis. He also demonstrated the characteristic histology of these lesions.

A new form or type of conjunctivitis named "agricultural conjunctivitis" has apparently been established by Gifford and Patton,[59] the bacteriologic findings being a mixed infection with a gram-positive anaerobic bacillus as the dominant micro-organism.

According to Woods,[60] allergic conjunctivitides may be caused by pollens, food, animal dusts, inhalants or bacterial toxins

and proteins. Clinical and experimental data suggest that vernal catarrh is an allergic disturbance. Radium for the treatment of vernal conjunctivitis has been employed by Quick.[61]

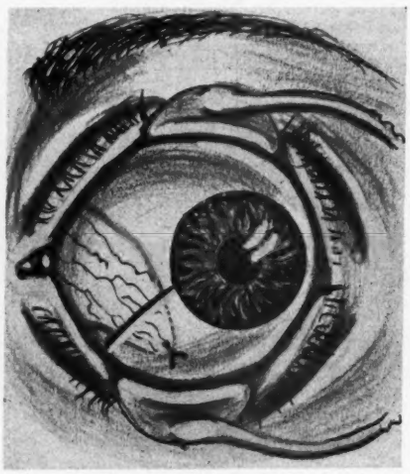

Fig. 1. Transplantation for pterygium. (From McReynolds, J. O. The nature and treatment of pterygia. *Tr. Sect. Ophth., A. M. A.*, p. 47, 1902.)

Thygeson[62] has employed staphylococcus toxoid to immunize patients with conjunctivitis, presumably due to toxigenic staphylococci. His results suggest that further clinical trial of staphylococcus toxoid is required. Studies on the action of staphylococcus toxin and antitoxin with special reference to ophthalmology have been reported by Burky.[63]

Trachoma. Although Noguchi did not discover the cause of trachoma, he did clarify our knowledge of follicular conjunctivitis by finding the Bacillus granulosus. In 1934, Thygeson[64] studied the nature of the elementary and initial bodies of trachoma and later[65] discussed the filtrability of the trachoma virus.

In investigating the infectivity of trachoma, Julianelle and Harrison[66] stated that antigenically, the infectious agent of trachoma appears to be ineffectual, since it stimulates neither antibody formation nor increased resistance during active infection.

The treatment of trachoma has apparently been revolutionized by the use of sulfanilamide. In 1939, Gradle[67] presented a review of the problem. Successful results have been reported by numerous investigators.[68] Sulfanilamide apparently has a rapid effect on the secondary infections associated with trachoma.

According to Thygeson,[69] sulfanilamide appears to be most efficacious in early cases of trachoma and when employed in relatively high dosages. However, healing has been obtained in certain longstanding cicatricial cases and in some cases in which low doses were given over a relatively long period of time.

Inclusion Blennorrhea. Thygeson[70] has stated that the etiologic agent of inclusion blennorrhea is a filtrable virus having an elementary body phase and an initial body phase. According to Julianelle and Lange,[71] diagnosis may be verified by the presence of cytoplasmic inclusions of the epithelial cells, which may be observed extracellularly.

Gonorrheal Ophthalmia. Fernandez and Fernandez[72] report that in a series of patients with gonorrheal ophthalmia, who received sulfanilamide, all recovered in a spectacular manner and in a shorter period of time than that required by other accepted forms of treatment. The treatment of gonorrheal ophthalmia by means of sulfanilamide has also been advanced by Bower and Frank.[73]

Surgery. In 1899, May[74] performed an operation for symblepharon in which he constructed a new cul-de-sac, using a large Thiersch graft. For total symblepharon, Weeks[75] employed a Wolffian graft, which he applied to a plate of hard rubber and placed in the orbit after canthotomy.

In 1902, McReynolds[76] devised a modification of transplantation for the correction of pterygium. (Fig. 1.) He emphasized the fact that there should be no incision along the upper border of the pterygium.

Gifford[77] found that the best results in pseudopterygium follow a free dissection of the scar tissue from the cornea and the placing of a Thiersch graft of skin on the raw surface.

In 1891, Knapp's roller forceps operation for trachoma,[78] which has been a valuable contribution to the surgical treatment of trachoma, was first described.

In cases in which the ocular conjunctiva is markedly diseased, as in trachoma and even in other ocular diseases, Denig[79] recommends that the diseased tissue should be replaced by strips of mucous membrane taken from the mouth and sutured into position on the eyeball.

EYELIDS

Surgery. If the association of blepharochalasis with the development of the endocrine glands can be substantiated, Benedict[80] believes that it is probable that some medical treatment can be applied for relief during the intumescent stages but that excision of the redundant skin is the only successful treatment.

Wheeler,[81] in 1920, published his original and modified blepharoplastic procedures which were the results of experiences in the last World War. The use of the orbicularis palpebrarum muscle in congenital absence of the external canthal ligament has been described by Wheeler.[82] H. and S. Gifford[83] slightly modified Machek's useful modification of the Panas operation for ptosis; Reese[84] used orbicularis strips instead of skin which he sutured to the occipitofrontalis. Lancaster, in 1919, showed that fascia lata could be advantageously used to connect the frontalis and the upper eyelid.

An operation for the correction of spastic entropion by attaching a strip of orbicularis to the orbital margin has been described by Wheeler.[85] Hughes[86] has described a method of rebuilding the lower eyelid which is similar to the technic employed by Dupuy-Dutemps,[87] except that the former uses the remaining tissue of the lower eyelid instead of a skin flap from the upper eyelid. The upper eyelid is split into two layers transversely. The inner layer composed of the tarsus with the levator attached to its upper border is pulled down and attached to the conjunctiva in the lower fornix. The skin of the cheek is undermined, pulled up and united to the anterior surface of the tarsus.

CORNEA

Keratitis. Although the exact etiology of keratitis bullosa is unknown and treatment is usually unsatisfactory, Davis[88] has reported a case of keratitis bullosa which responded well to *x*-ray treatment and Pfeiffer[89] has successfully used Grenz rays. According to Green,[90] the surgical removal of Bowman's membrane in two cases of bullous keratitis permitted permanent adhesion of newly formed epithelium to the substantia propria. Green's results seem to support the theory that the essential cause of bullous keratitis is a disease or alteration of Bowman's membrane.[91]

After a study of 225 patients with dendritic keratitis, Gundersen[92] concluded that the application of a strong solution of iodine is the most effective known treatment because it destroys the virus infected corneal epithelium.

According to Johnson and Eckardt,[93] rosacea keratitis may be the direct result of deficiency of riboflavin, which is one of the factors in vitamin B_2 complex.

In 1935, Beetham,[94] in treating patients suffering from filamentary keratitis (keratoconjunctivitis sicca), advocated destruction of the canaliculi in an effort to utilize the small amount of lacrimal secretion, which is characteristic of this disease. In 1925, Verhoeff[95] stated that this lesion is essentially an exposure keratitis, arising when there is a deficiency of lacrimal secretion. The importance of the seventh nerve in the innervation of this gland is pointed out; as well as the fact that this nerve may be injured in Gasserian ganglion operations. He also showed that blood transfusion from a donor who had recovered from, and was therefore immune to herpes zoster had marked curative value in herpes zoster ophthalmicus.

Walker and Walker[96] have used diphtheria antitoxin in the treatment of acute and chronic herpes zoster ophthalmicus. This treatment has been most successful

in their cases. In 1919, Key[97] advocated the use of antidiphtheritic serum in hypopyon keratitis and other severe ocular infections.

Kayser-Fleischer Ring. The Kayser-Fleischer ring (Wilson's disease) has been discussed by Goldbach[99] who reported three cases of hepatolenticular sclerosis. He believes that the features of this disease indicate a toxic agent. As the disease is probably hereditary, the conclusion by analogy would be that it is based on a primary disturbance of metabolism.

Surgery. In 1899, Baker[100] introduced a technic of keratoplasty employing a "shirt-stud" shaped transparent glass which he attached after excising the opaque cornea. In 1930, Key[101] attempted total transplantation. He dissected a circumcorneal area of conjunctiva for a distance of 4 mm. and then completed the section of the cornea with a large keratome and cataract knife.

In 1934, Castroviejo[102] advised excising a square area of opaque cornea using a new double bladed knife and transplanting healthy cornea, which he completely covered by two conjunctival flaps. He[103] had some success in grafting a rectangular fragment into a leukomatous cornea. In 1926, Wiener[104] advised the resection of corneal opacities.

The ball cautery, devised by Wadsworth for the treatment of corneal ulcers, was modified by Todd[105] in 1908; he used a copper ball with a platinum point.

In 1918, Gifford[106] described the technic of delimiting keratotomy, which has proved of great value in treating corneal ulcers. Hypotony is produced by incising the cornea, tangent to the border of the ulcer. Wiener[107] suggests "a safer method," involving the same principle of penetrating the cornea beyond the border of the ulcer, emerging on the opposite side, and then turning the blade of the knife forward with a single sweep.

Whenever signs of increased tension develop in association with corneal ulcers, Weeks[108] advocated opening the anterior chamber. Several valuable operations have been suggested for the treatment of conical cornea, and Wiener[109] combined peripheral iridectomy with excision of the upper peripheral part of the cornea. The operation described by Green and Green[110] combines canthoplasty, iridectomy and then excision of a crescent-shaped area of sclera. Transplantation of the cornea has been successful.

LENS

Allergy and Immunology. That allergic inflammation of the eye "endophthalmitis phacoanaphylactica" might result from hypersensitiveness to lens protein was first suggested by Verhoeff and Lemoine.[111]

According to Woods and Burky,[112] the experimental production of cataracts by immunologic procedures is a controversial subject. They state that after rupture of the lens capsule a certain percentage of individuals may develop a cutaneous hypersensitivity to lens protein, the only apparent source of which is their own lens which presumably acts as the sensitizing antigen. These investigators believe that the fully developed lens capsule is probably impermeable to antibodies.

Davis[113] has claimed that by the therapeutic injection of lens antigen, the progress of immature cataract could be retarded or checked and formed opacities could be liquefied and absorbed by cytolytic action. Although this work has not been completely substantiated, lens antigen may act as a nonspecific agent in raising resistance. The production of hereditary anomalies of the eye in relation to the use of lens antigen and uveal pigment has been discussed by Davis and Smith.[114] The study of hereditary eye anomalies is important because 49 per cent of the children in schools for the blind in the United States for the school year 1937 to 1938 were classified as blind from prenatal causes.

Permeability of Capsule. After studying the permeability of the lens capsule, Friedenwald[115] concluded that its permeability is qualitatively the same in vivo as in vitro, and that the capsule is permeable to

all electrolytes and true solutes in water, as well as to small and medium sized colloidal particles. In these experiments, normal lenses, kept in sterile salt solution at body temperature, became cataractous if foodstuffs were not supplied and metabolic products not removed. Such cataracts resemble, both on slit lamp and histologic examination, spontaneous senile cortical cataracts.

Cataract Caused by Drugs. Certain drugs recently employed have been blamed for the production of cataract. Numerous cases of cataract following dinitrophenol treatment for obesity have been reported,[116] as well as a few cases of cataract following the administration of dinitrocresol. Experimentally this has not been proved.[117] Cataract following sulfanilamide therapy of iridocyclitis in a patient with latent gonorrhea has been reported by Van Lint and Alaerts.[118]

Chemistry of Lens. The capsule contains less total nitrogen and more aminonitrogen than the other lens proteins. According to Krause,[119] the large amount of carbohydrate in the capsule suggests that it is related to the mucoprotein of the lens.

Hektoen[120] has shown that the alpha and beta crystallins were precipitogenically distinct. A method of obtaining almost pure preparations of both the alpha and beta bodies, so that they react only to their own antibodies, has recently been perfected by Burky and Woods.[121] These authors[122] also reported the isolation of a third protein which they have called gamma crystallin.

In 1911, Clapp[123] demonstrated the presence of a substance which changed the insoluble albuminoid of the lens to a soluble compound which he believed to be a proteolytic ferment. Burge[124] was able to estimate not only the amount of ash in normal human adult lenses, but also the amount of potassium.

It has been shown by Tassman and Karr[125] that in normal pig's lens, glutathione was present in 0.296 per cent and that a definite ratio was established between cystein and cystine of 0.296/0.704 or 0.420. It was also determined that glutathione was entirely absent in cataractous lenses.

According to Verhoeff,[126] crystals found in coralliform cataract are protein in nature and this is probably the first instance of protein crystals observed in the body.

Medical Treatment. In discussing the medical treatment of cataract, Greenwood[127] stated that the nonoperative treatment may be divided into four varieties: (1) hygienic; (2) local applications; (3) electricity, radium and *x*-ray, and (4) lens antigen. Greenwood advises the hygienic treatment and the intermittent use of dionin. He also believes an improvement in vision and a retarding of the progression is more likely, if coincident with the use of dionin treatment, there is an improvement in the general condition, with an elimination of all foci of infection or abnormal blood states. No treatment is of value according to Kirby.[128] The relation of avitaminosis to the etiology of cataract has aroused much interest. Langston, Day and Cosgrove[129] have studied the production of cataract and other ocular changes in albino mice by the administration of a vitamin G deficient diet. Cataract appeared in 96 per cent after an average of forty-eight days on the deficient diet, and ophthalmia in 57 per cent after fifty days.

Operations on the Lens. Apparently Williams,[130] of Boston, was the first to describe the use of a suture in cataract operations. Many modifications of Williams' technic have been proposed. Several methods to ensure accurate adjustment of the lips of the wound after tying the sutures have been devised by Verhoeff.[131] He has described a special instrument for the insertion of corneoscleroconjunctival sutures in cataract operations.[132] Blake[133] has devised a conjunctival flap holder for cataract sutures. A scleroconjunctival suture was described by Derby.[134] Recently, McLean[135] developed a new type of corneoscleral suture; a small groove is made beneath the conjunctival flap with the

Lundsgaard knife. Lancaster, in 1940, devised a special knife for this purpose. The suture is placed through the scleral and

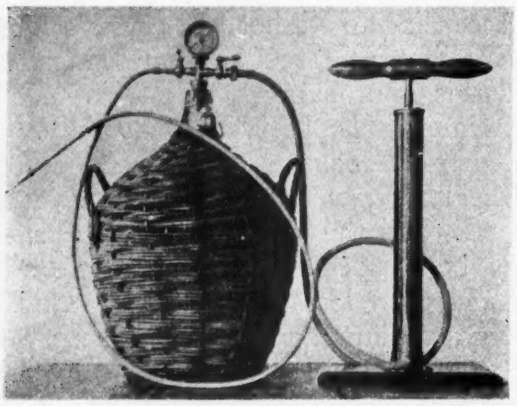

Fig. 2. Vard Hulen apparatus for the intracapsular extraction of cataract. (From American Encyclopedia of Ophthalmology, 3: 1549, 1914, Chicago, Cleveland Press.)

corneal lips of the groove before the section is made.

Ellett[136] has done a great deal to popularize the use of sutures and especially the Kalt suture; he has lived to see most of the ophthalmic surgeons in the United States of America using some form of suture in cataract operations.

In 1900, Herman Knapp[137] introduced his method of opening the capsule by a peripheric incision. Homer Smith[138] and Wandless[139] both advocated division of the capsule as a preliminary step to the removal of the cataract, especially but not solely, in cataracts which are immature.

In 1902, the cataract incision was modified by Wilson and Miles[140] in order to make a flap of conjunctiva adhering to the cornea.

Americans have done much to advance the intracapsular method of extracting the lens. In 1913, Knapp[141] suggested a method by which he partially luxated the lens by means of capsule forceps, after performing iridectomy, and expressed it in its capsule. The Stanculeanu-Knapp-Torok method[142] has been advocated by many surgeons, and Knapp's method[143] of traction with expression after iridectomy has been a great factor in popularizing the intracapsular extraction.

Reese[144] believes that radiation cataract is particularly suitable for intracapsular extraction because of the proliferation of

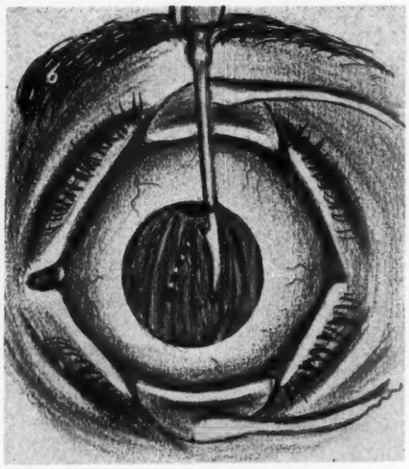

Fig. 3. Complete discission of the lens by the V-shaped method. (From Ziegler, S. L. Complete discission of the lens by the V-shaped method. *J. A. M. A.*, 77: 1101, 1921.)

the epithelium under the anterior capsule into a metaplastic fibrous layer.

The first satisfactory suction cup instrument for intracapsular extraction of cataract was devised by Hulen.[145] (Fig. 2.) Dimitry[146] has recently evolved a new syringe type of suction apparatus, which is proving practical. Green[147] has devised a modification of the Barraquer apparatus.

Much attention has been given to methods of incising secondary membranes; and in 1898, Herman Knapp[148] stated that the opening must be made by cutting and not by tearing. He devised knife-needles with a cutting edge much longer than that of an ordinary cataract needle. Ziegler[149] also designed a special knife-needle with a very fine point, a straight cutting edge 7 mm. in length, and a round shank of sufficient size to block the opening and prevent the escape of the aqueous humor. He advocated an inverted v incision. No mention of complete discission of the lens by an incision anterior to the iris apparently appears in the literature prior to Ziegler's publication of his practical method of making an inverted v incision through the anterior and posterior capsule with his discission knife.[150] (Fig. 3.)

In secondary cataract, Wheeler[151] advocated a single straight incision across the iris muscle fibers using a special knife in order to make an artificial pupil. D. W. Hunter had previously employed a ground-down Graefe knife for the same purpose.

The removal of soft lenses and dislocated lenses has been facilitated by the development of the Hildreth ultraviolet lamp.[152]

In 1915, Verhoeff[153] recommended scleral punctures for subchoroidal hemorrhage following cataract extraction or sclerotomy and also for persistent cases of choroidal detachment. Verhoeff was the first to save an eye following intraocular hemorrhage and in 1931, Samuels[154] explained the method of handling this complication.

According to O'Brien,[155] detachment of the choroid after cataract extraction occurs almost invariably at the time of operation. For cataract extraction, O'Brien[156] advises a method of paralyzing the temporofacial branch of the seventh nerve as it lies in the upper part of the parotid glands. In the extraction of cataract, avertin anesthesia has been advocated by Davis[157] and pantocain by Wilmer and Paton.[158]

In 1921, Bell[159] introduced his method of preventing postoperative intraocular infections by instilling two drops of a 1 per cent solution of silver nitrate into each eye.

OPERATIONS ON THE LACRIMAL APPARATUS

One of the most outstanding advances in ophthalmic surgery is dacryocystorhinostomy in place of excision of the lacrimal sac. Prior to West's operation, intranasal operations involved the removal of a part of the inferior turbinate. West[160] advocated a window resection of the lacrimal duct above the inferior turbinate, leaving this structure intact. In 1902, Buller[161] ligated the canaliculi to isolate an inflamed lacrimal sac from the conjunctiva. Subconjunctival section of the ductules of the accessory lacrimal gland for excessive lacrimation has been described by Jameson.[162]

RETINA

Retinitis. In 1892, Knapp[163] described the formation of dark angioid streaks as an unusual metamorphosis of retinal hemorrhage. In 1928, Verhoeff[164] stated that the cause of the fibrosis in angioid streaks is obscure but that the most probable one may be a slowly progressive vascular obstruction limited to the affected area. In 1937, Benedict[165] studied the pathology of angioid streaks.

In 1927, Wagener[166] described a new type of retinitis associated with malignant hypertension. His important studies have established a distinction between retinal angiosclerosis of purely local origin and one which suggests general vascular involvement.

Holloway's and Verhoeff's clinical and pathologic researches[167] have advanced the knowledge of the histopathology of gross macular disorders.

Tumors. A classification of tumors of the glioma group on a histogenetic basis with a correlated study of prognosis was made by Bailey and Cushing.[168] Martin and Reese[169] have successfully treated certain cases of retinal glioma by means of the fractionated or divided dose principle of roentgen radiation.

Retinal Blood Vessels. H. Friedenwald[170] and Preston were apparently the first Americans to report accurate ophthalmoscopic examinations of patients with general arteriosclerosis. In 1896, Friedenwald[171] published a paper on the significance of constrictions and dilations of the caliber of the retinal arteries in arteriosclerosis. In 1930, further studies[172] were published by him.

It has been shown[173] that in subjects examined to determine the influence of posture on retinal blood pressure, a marked increase in retinal diastolic pressure was noted as the subject changed from the standing to the prone position. Repeated study of the blood pressure in the central artery apparently aids in the establishment of an early diagnosis of increased intracranial pressure in the absence of papilledema.

Puntenney[174] reports that the only measurable effect of lowering the intraocular

pressure with the Kukan apparatus[175] was a slight dilatation of the retinal veins. In the experiments in which amyl nitrite, mecholyl, epinephrine, nembutal, hyperpyrexia and cold pressor tests were studied measurable dilation of the veins was recorded in several cases with mecholyl. Lambert[176] has described a method for studying the retinal circulation of animals so that the size of the vessel at any point can be determined in microns.

In studying retinal perivascular delineation, Evans[177] found prussian blue particles about the vessels and cells. He states that it must not be assumed that they are in a formed space, in an anatomic sense, or that their passage from vitreous to retinal and nerve spaces indicates the rate or direction of normal fluid flow.

Chemistry. Important and fundamental advances in regard to the chemical changes which follow the incidence of visible light upon the retina have been made by Hecht.[178] He demonstrated that the initial reaction in the visual process is a simple photochemical one. Moreover, he showed that light adaptation is accompanied by the diminution, and dark adaptation by the accumulation of the photochemical substance in the retina.

Mathematically, Venable[179] has shown that the absorption of light by the visual purple and the subsequent energy interchanges, affecting this substance, can be interpreted as occurring in quanta. According to Venable, color sensation is ascribable to the number of synchronous discharges involved, two, three or six of these being liberated or absorbed at the same time.

The sedimentation constant of visual purple has been studied by Hecht and Pickels.[180] Hecht[181] has also investigated the rods, cones and the chemical basis of vision.

Valuable work on the carotenoids and the visual cycle has been done by Wald.[182] In recent years, night blindness and similar visual disturbances, associated with the nutritional state of the body, have been traced to vitamin A contained in the diet. The chemical relation between vitamin A and the light sensitive pigments of the retina has also been studied by Wald.

After studying the metabolism of the retina, Adler[183] concluded that the low concentration of sugar in the vitreous is due to the high rate of glycolysis of the normal retina.

Operations on the Retina. A simple needle for the diathermy treatment of retinal detachment has been designed by Gradle.[184] A technic of treating the flat type of separated retina and of macular holes with special applications and a compact diathermy and electrolysis apparatus has been devised by Walker.[185] He has also advocated the use of very slanting punctures made with a "beading needle" and reaching for a distance of 2 to 3 mm. between the sclera and choroid.[186]

AQUEOUS CIRCULATION

The rate of flow of the aqueous circulation has been studied by Friedenwald and Pierce.[188] They concluded that there exists a continuous through and through circulation of aqueous solution within the eye. These investigators[189] in studying the mechanism of reabsorption of the aqueous humor concluded that the reabsorption occurs almost exclusively from the anterior chamber.

Knowledge of the anastomoses and anatomic relations of Schlemm's canal have been added to by Theobald,[189a] who found the collector channels to be more numerous than is ordinarily believed. (Fig. 4.)

In a study of the posterior outflow of fluids from the eye,[187] it was found that part of the material injected gained access to the perivascular regions of the central vessels of the optic nerve in the eye of the rabbit and in one normal human eye; no stain was found around the central vessels in four pathologic human eyes, the eyes of dogs or guinea pigs.

OPTIC NERVE

Electrical Responses. The electrical responses accompanying activity of the optic

pathway have been studied by Bishop.[190] He showed that the action currents of the optic cortex and retina differ from those of abnormal proliferation of the normal adult types of neuroglia of the nerve system. Tumors of the optic nerve, in Davis'

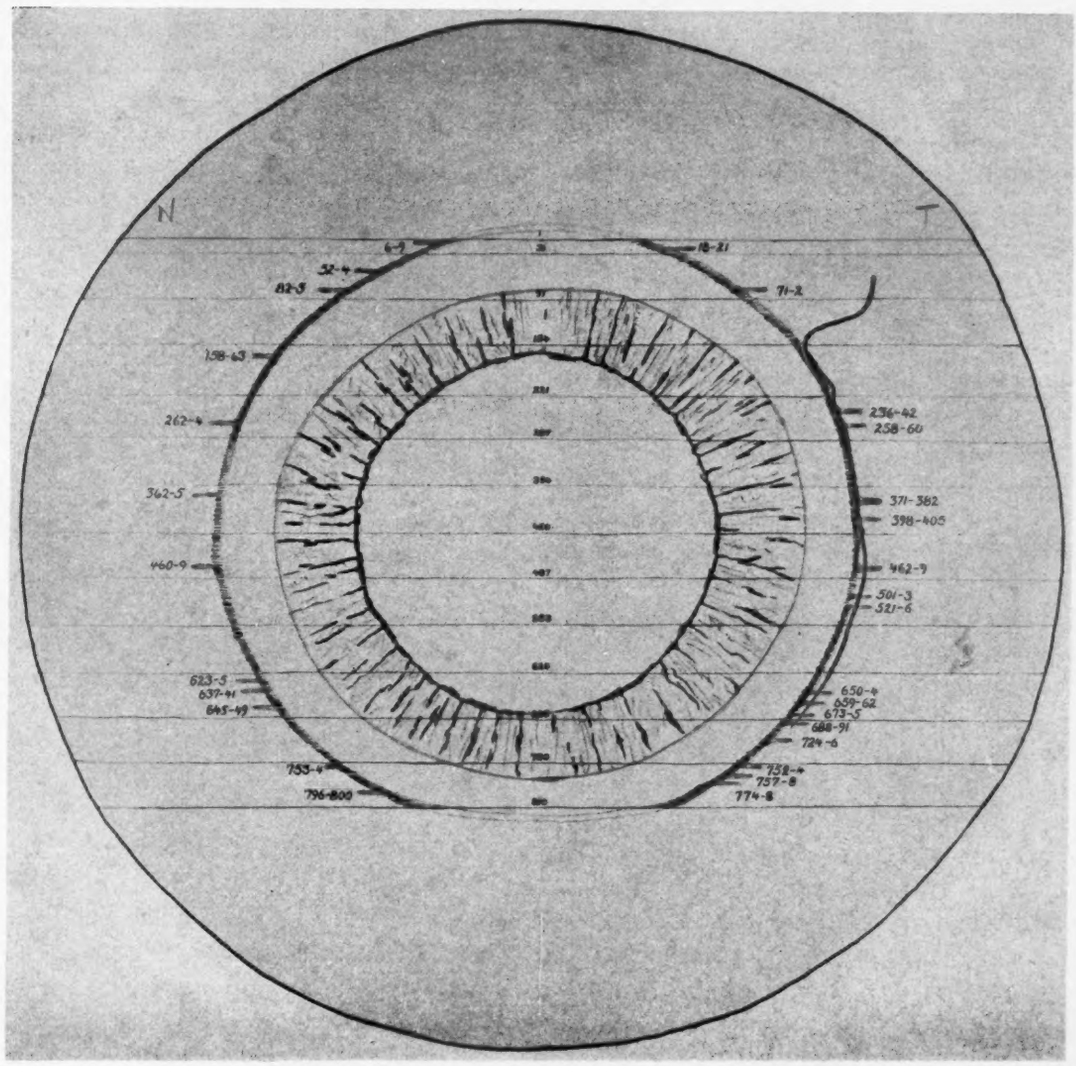

FIG. 4. Reconstructed from 810 serial sections. The space between the horizontal lines represents 1 mm. No. 420 is the center section. Illustration shows: (1) Twenty-nine collector channels leaving the canal of Schlemm at irregular intervals. They are most numerous in the lower temporal quadrant, where there are as many as 5 to 1 mm. At No. 469 to 623, and T. 72 to 236, the space between is more than 2 mm. (2) A large artery is shown joining the canal of Schlemm at Section 159, and running along intimately with it for more than 8 mm. (From Theobald, G. D. Schlemm's canal: its anastomosis and anatomic relations. *Tr. Am. Ophth. Soc.*, 32: 574, 1934.)

the peripheral nerves in being of longer duration and of different form.

Tumors. Verhoeff's investigation of tumors of the optic nerve[191] resulted in a demonstration that the most usual growth is glioma. Martin and Cushing[192] have added to the knowledge of primary gliomas of the chiasm and optic nerves. According to Davis,[193] glial tumors start with an opinion, are usually a part of a more widely disseminated lesion of the peripheral and central nervous systems, commonly referred to as neurofibromatosis or Recklinghausen's disease.

Early diagnosis by ophthalmologists of meningiomas arising from the tuberculum sellae has been urged by Cushing and Eisenhardt.[194] The syndrome of failing

vision, primary optic atrophy and bitemporal field defects combined with a normal sella turcica encountered in middle-aged persons should lead to early operation.

Toxic Amblyopia. The first description of a case of blindness caused by methyl alcohol in the United States was reported by J. M. Ray.[195] In 1914, Tyson and Schoenberg[196] revealed that methyl alcohol in the eye produces a toxic edema of the tissues, which with the increased viscosity of the blood, interferes with its free circulation.

The important analysis of 153 cases of blindness and 122 deaths attributable to methyl alcohol by Wood and Buller[197] and Ziegler's report[198] in 1921 served as a warning concerning the serious complications associated with methyl alcohol even in small quantities, by inhalation and even by absorption through the cutaneous tissues[199] and as a beverage or an adulterant.

When a toxic neuritis, associated with tobacco or alcohol exists, a careful study frequently reveals that both drugs are active. In the studies of de Schweinitz and Edsall[200] a chemical analysis of the secretions from the urine demonstrated the presence of enterogenous decomposition products in the subjects with amblyopia caused by tobacco and rapid improvement when normal metabolism was restored.

In 1937, Carroll[201] studied eight patients with tobacco-alcohol amblyopia. After hospitalizing this group, he permitted them to continue to smoke and drink as much as they had while contracting the disease. However, he placed them on a high vitamin B well balanced diet. All but one patient showed satisfactory results and obtained vision for reading. The speed of recovery seemed to be at least as good in these patients as in patients, previously studied, who abstained from tobacco and alcohol.[202]

The first effort to produce amblyopia experimentally with quinine in this country dates from 1890 when a series of researches by de Schweinitz[203] demonstrated that toxic doses of quinine in dogs produced a replica of the picture of the fundus in human beings, atrophy of the nerves, optic tracts and chiasm. Holden's experiments[204] in 1898 indicated that quinine is a direct poison to the retinal ganglion cells, which causes the ascending degeneration of the optic nerve, chiasm and optic tracts.

Optic Atrophy Associated with Syphilis. The subdural treatment of syphilitic primary optic atrophy, according to Moore and his associates,[205] produces permanent arrest of optic atrophy in about half of the patients adequately treated. However, there is a risk of sudden loss of vision in about 10 per cent of cases.

Papilledema. Parker[206] has shown that the edema of the nerve head is usually greater in the eye with the lower tension. Papilledema did not occur in dogs with the benign type of experimental hypertension examined by Keyes and Goldblatt[207] as long as the excretory function of the kidney remained normal. Decreased renal excretory power was usually followed by ocular changes characterized by edema and detachment of the retina, papilledema and hemorrhages.

VITREOUS BODY

Holloway studied[208] asteroid hyalitis "snow-ball opacities" and synchisis scintillans. Friedenwald and Stiehler[209] believe that the vitreous body consists of a solid framework composed mainly of very thin, concentrically arranged sheets. They state that the spaces between the sheets are filled with a viscous fluid.

MOTOR ANOMALIES

The terms exophoria, esophoria, hyperphoria and cyclophoria were introduced by G. Price and Giles Savage[210] in the last decade of the nineteenth century. Stevens[211] was one of the first to classify motor anomalies. In 1897, Duane[212] published a new classification of motor anomalies of the eye which greatly clarified the subject.

Lucien Howe's systematic contribution[213] to the study of ocular muscles is invaluable. Lancaster has made valuable additions to the mechanism of muscular action[214] and

to diagnosis.[215] Through his book[216] and his numerous publications,[217] Peter has added to our knowledge of many important problems. The studies of White[217a] and Dunnington[217b] have clarified our knowledge of motor anomalies.

Anisophoria. Anisophoria has been defined by Friedenwald[218] as that form of heterophoria in which the degree of muscular imbalance varies with the direction of gaze. He points out that anisophoria may be produced by the correction of anisometropia with ordinary spectacle lenses as well as by the unequal action of the extraocular muscles.

Orthoptic Training. Guibor[219] has contributed valuable data on orthoptic training. The importance of orthoptic treatment combined with surgery of the ocular muscles is now gradually being accepted. The role of the orthoptic technician as an aid to ophthalmologists has been emphasized by J. E. Lancaster.[220] These technicians are now assuming an important place in the treatment of motor anomalies.

Fusional Movements. One of the most interesting results shown by Burian's experiments on fusional movements[221] is that peripheral retinal stimuli are strong enough to break the fusion of images situated on corresponding areas of the macular region, provided they cover a sufficient area.

Anomalous Retinal Correspondence. Much is still to be learned concerning anomalous retinal correspondence. According to Burri,[222] the classic assumption that the two retinas correspond exactly by either a cell or a retina to cortical area relationship has no neurologic proof so far, beyond the discovery of a certain topographic arrangement of the retina in the cortical centers. Burri believes that knowledge points toward a dynamic plasticity rather than toward a static anatomic relationship. Verhoeff[223] has studied anomalous projection and other visual phenomena associated with strabismus.

Stereopsis. Wells[224] has made an outstanding contribution to the use of the stereoscope in ophthalmology. The study of depth perception has been advanced by the Howard modification of the Brooks Bank James apparatus[224a] which is used extensively for studying stereopsis.

Accommodation. There have been several valuable additions to our knowledge of accommodation during the last fifty years. The world is indebted to Duane[225] and Jackson[226] for their excellent studies on the amplitude of accommodation at various ages which added to the original work of Donders. Also Duane's studies of binocular accommodation as contrasted with monocular accommodation demonstrate that as a rule with both eyes the near point of accommodation is closer to the eyes than with each eye separately and that this difference lessens somewhat with increasing age. We are also indebted to Duane[227] for his excellent classification of anomalies of accommodation.

Although there is still much controversy concerning the mechanism of accommodation, the fine work of Luedde[228] points more toward the Tscherning theory. Ferree and Rand[229] through their apparatus (tachistoscope) for studying inertia of adjustment of accommodation have added much to our knowledge of this subject. In their studies published in 1918, the time required for eighteen normal observers to pass from near to far varied between 0.50 and 1.16 seconds, a range of 132 per cent, and from far to near between 0.39 and 0.82 seconds, or a range of 110.3 per cent. In 1939, Ferree and Rand described a multiple-exposure electrical tachistoscope.

Cogan's[230] brilliant researches have clarified the mechanism of adjusting the eyes for distant vision.

There is no doubt that accommodation is an important factor in asthenopia as originally pointed out by Donders; the development of the ophthalmic ergograph for the study of accommodation and convergence[231] and Howe's and Lancaster's studies[232] of fatigue of accommodation have been of great importance in the study and treatment of patients who

complain of ocular fatigue during close work.

Operations on the Ocular Muscles. In

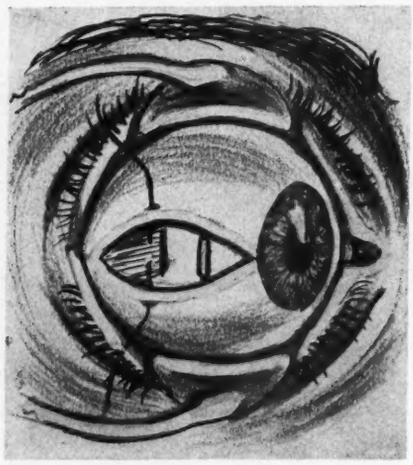

Fig. 5. Curdy recession operation. Suture is introduced before tendon is divided.

1889, Stevens[233] recommended a modification of Critchett's operation for those cases of heterophoria which cannot be sufficiently corrected by tenotomy.

Jackson[234] suggested that it would be possible to overcome the disturbance due to paresis of the superior oblique, at least to some extent, by operation of the superior rectus. Extraocular tendon lengthening and shortening operations which permit the surgeon to regulate the effect were advocated by Todd.[235]

The technics for resection most widely used in this country are those of Reese,[236] Lancaster[237] and Wilkinson.[238] The recession operation on the medial rectus was first performed by Curdy[239] (Fig. 5); his technic was modified by Jameson,[240] Agatston[241] and other surgeons.

For shortening tendons, O'Connor proposed the popular cinch operation[242] which was devised to eliminate strain on the stitches after advancement operations. In 1917, Jackson[243] reported that he had performed transplantation of the superior oblique on cadaver eyes in order to prevent extreme divergence.

An operation on the superior oblique to use it as an internal rotator in third nerve paralysis has been performed by Peter.[244] Superior oblique and inferior oblique advancement operations were devised by Wheeler.[245] Graduated tenotomy of the inferior oblique muscle as an aid in the correction of certain forms of squint has been advocated by McCool.[246]

In 1917, Woodruff[247] performed partial tendon transplantation of the vertical recti muscles in two cases of paralytic convergence. Key[248] advocated transplantation of the temporal half of the vertical recti tendons in cases of complete paralysis of the external rectus. Transplantation of portions of the vertical recti tendons to strips of the external rectus tendon was performed by O'Connor.[249] He[250] has also devised three methods of transplanting the ocular tendons.

EXAMINATION OF THE EYE

Several advances in instruments and methods of examination have been made in this country. Of a number of tonometers designed the most used are those of McLean[251] and Gradle.[252]

Ferree and Rand[253] have made valuable contributions to the testing of visual acuity. Among the factors they have discussed are the sensitive use of the test for the detection of errors of refraction, the comparative merits of test objects and a new type of test object consisting of a broken circle.

Light Sense. Ferree and Rand[255] have also devised an instrument for testing light and color sense. A few instruments have been designed for the study of dark adaptation. The Feldman apparatus[256] is useful for the qualitative study of dark adaptation. An excellent adaptometer for measuring human dark adaptation has been designed by Hecht and Shlaer.[257] Ferree and Rand have devised an attachment for the Ferree-Rand perimeter for measuring light and color minima.[258]

Crampton[259] was the first to utilize a battery handle for the electric ophthalmoscope. A "U" shaped mirror for the ophthalmoscope was made by Marple.[260] The May ophthalmoscope is another practical advance in the examination of the

eye; it is useful not only for ophthalmoscopy but also for external examination by the use of the slit beam.

In 1924, Friedenwald[261] described a freely movable instrument for monochromatic ophthalmoscopy with yellow-green light. A year later, he discussed visibility of the retinal capillaries with yellow-green light.[262] In 1929, Friedenwald published his clinical studies on slit-lamp ophthalmoscopy.[263] In 1932, he described a new ophthalmoscope,[264] which was devised to make possible the adaptation of principles of slit-lamp microscopy to the examination of the eye ground and posterior vitreous body. Evans[265] also described slit-lamp ophthalmoscopy. Dobson[266] has described the examination of the fundus oculi by light of limited spectral range.

The atlas[267] published by Bedell and his numerous monographs have enriched the literature and advanced the science of ophthalmoscopy.

Gonioscopy. Troncoso[268] devised the gonioscope for the examination of the angle of the anterior chamber, which has been especially useful in determining the need for glaucoma operations.

Retinoscopy. Jackson[269] developed the technic of retinoscopy with the plane mirror and he[270] was the first to describe the crossed cylinder. In 1890, Jackson discussed retinal illumination[271] and in 1895, the first edition of his volume on skiascopy was published.[272] His method of objectively measuring the power of accommodation appeared in 1905.[273]

Transillumination. Transillumination of the eye is another important development; Würdemann[274] was one of the early originators of this form of examination.

Foreign Bodies. Sweet's method of localization of foreign bodies in the eyeball with roentgen rays[275] and Dixon's modification[276] have been outstanding contributions.

Muscles. Stevens has made important contributions to the examination of the ocular muscles. The Stevens tropometer and phorometer[277] aid in the more accurate diagnosis of motor anomalies.

One of the most accurate methods of testing for cyclophoria is the clinoscope.[278] Jackson[279] has suggested fusion tubes for the diagnosis and treatment of cyclophoria. An ingenious spectacle for the nonoperative treatment of cyclophoria has been developed by Ames[280] and Lancaster.[281] Ames' methods of measuring cyclofusional amplitude, cyclophoria and cyclotropia are distinct advances in the diagnosis of motor anomalies.

Perimetry and Campimetry. Important developments in perimetry in this country have been made possible through the greater use of the tangent screen, improved illumination, development of better test objects and more knowledge concerning the physiology of vision. Walker has added greatly to the subject of quantitative perimetry, especially in his work with Cushing[282] in the field of neuro-ophthalmology. The work of these authors has given ophthalmology a new insight into the symptomatology of tumors in the temporosphenoidal lobe by pointing out the localizing importance of partial or quadrantic defects of the visual fields. These authors have also enriched our knowledge of various changes observed in pathology in the pituitary region, and the work of de Schweinitz and Schaeffer[283] has clarified the underlying anatomy. More recently, Elsberg[284] and his associates have studied the relation of the nervous system and the brain to visual phenomena. In 1937, in evaluating quantitative visual tests for localization of supratentorial tumors of the brain they stated that their visual tests, although they did not reveal the anatomic structures involved in tumors of the brain, did demonstrate the disturbances of function caused by these new growths.

Through the painstaking work of Evans[285] the importance of angioscotometry has been greatly increased. He has made important contributions in the field of glaucoma, retinal edema and quinine amblyopia; more recently it appears that he may have suggested a means of determining the early signs of pregnancy, by

showing that there is a scotoma above the blind spot in women who are about to menstruate which is apparently not present when they are pregnant.

Through the development of scientific apparatus and technics, Ferree and Rand[286] have added greatly to our knowledge concerning the normal visual fields in different refractive errors and some pathologic conditions. The Ferree-Rand perimeter is an outstanding development in ophthalmology. The Lloyd stereocampimeter improved on the study of the central visual field in certain cases by facilitating binocular fixation.

PHOTOGRAPHY OF THE EYE

Bedell has done much to popularize the use of photography in studying and illustrating internal conditions of the eye.[287] According to Mann,[288] the practical utilization of infra-red photography in ophthalmologic practice seems limited to the visualization of the anterior portion of the eyeball, especially in cases of corneal opacities, in which no other means of examination will reveal abnormalities of the iris and pupil.

Stereoscopic photography is increasing in importance because many pathologic details may be recorded which could not be illustrated in a single picture. Redway[289] has stressed the importance of color photography for improved teaching of ophthalmology. In 1929, he[290] published a simplified technic for instantaneous color photography of the living human eye.

REFRACTION

Refractor. One of the new instruments, which is of value in refraction, is the Leland refractor,[291] which utilizes polarized light. The advantages are not only that it is a sensitive test for the axis and amount of astigmatism but also an instrument which permits a balancing of the spherical correction as well as adjustment of the axis of the cylinders in binocular vision. In cases of muscular imbalance the instrument indicates the spherical changes required or, if prisms are indicated, the proper amount.

Aniseikonia. Ames and his associates[292] have developed the ophthalmoeikonometer and special lenses for the study and correction of aniseikonia. The correction of the difference in size of images has been a factor in relieving asthenopic symptoms in certain patients. Induced size effect has been studied by Ogle[293] with restricted fusion stimuli and in relation to asymmetric convergence.

Lenses. Many new forms of bifocals have been designed for special purposes.[294] Hardened ophthalmic lenses are also being used.[295] Olsho[296] has described thin lenses and bifocals for high myopia. New plastic materials are now used[297] for grinding shatter proof lenses.

Telescopic Lenses. Feinbloom[298] has developed new types of telescopic lenses. Berliner[299] has developed a new type of spectacle consisting of a fused telescope. Bettman and McNair[300] have constructed a spectacle with a contact lens-telescopic system, which permits an unrestricted field of vision.

Contact Lenses. The power and magnification properties of contact lenses have been investigated by Boeder.[301] Numerous aids in fitting contact lenses have been developed.[302] Feinbloom[298] designed a plastic contact lens. Contact lenses with spheric optic and aspheric haptic parts have been described by Nelson.[303] The fitting of contact lenses for patients with ametropia has been discussed by Obrig.[304] Stevens[305] in 1936, developed a method of making casts of the human cornea in fitting contact lenses. Contact lenses made from molds have been described by Obrig.[306]

ILLUMINATION

Improved illumination as a result of the development of the incandescent bulb has been a factor in facilitating ophthalmologic examination. Artificial daylight illumination was developed to a high point by Macbeth.

Ferree and Rand have made many valuable contributions to the use of illumination in examining the eyes.[307] In 1928, Hecht[308] studied the relation between visual acuity and illumination. Lancaster[309] has been outstanding in his investigations of light, especially in relation to ophthalmologic patients.

Most complete studies of illumination have been made by Luckiesh and Moss.[310] In their book, "The New Science of Seeing," they report numerous experiments concerning the effect of illumination on experimental subjects, e.g., pulse rate and metabolism. McFarland[311] has also contributed to the study of illumination in relation to pulse rate and metabolism.

TREATMENT

Radiant Energy. The pathologic effects of radiant energy on the eye were described by Verhoeff and Bell in 1916.[312]

The treatment of diseases of the eye with Grenz rays has been discussed by Pfeiffer.[89] He contends that Grenz rays are as efficacious in the treatment of superficial lesions of the eye as any other form of radiant energy and that they do not have the disadvantages of similar therapies.

Shahan[313] devised the thermophore with which the degree of heat can be exactly determined in treating ulcers, tumors and retinal detachment.

Vitamins. Yudkin[314] has made valuable contributions to the study of vitamins in the treatment and prevention of ocular diseases.

Vaccine. Howard,[315] in 1928, described the intravenous use of typhoid-paratyphoid vaccine in diseases of the eye. In the hands of Brown[316] the use of typhoid H antigen before intraocular operations has proved valuable.

Transfusion. The role of transfusion in ophthalmology has been stressed by Frey[317] who states that transfusion is a splendid nonspecific therapeutic reinforcement.

Tuberculosis. Gay[318] has made valuable contributions to the treatment of ocular tuberculosis with tuberculin. Rich,[319] in 1929, showed that in ocular tuberculosis "while allergy was truly responsible for the destructive, inflammatory caseating and necrosing phases of the tuberculous lesion, immunity was a totally separate process."

AVIATION OPHTHALMOLOGY

Aviation medicine made rapid strides in the last World War. Numerous phases of the reaction of the eyes to altitude and flying stress have been studied. Wilmer and his associates[320] demonstrated that low oxygen tension and not low barometric pressure was the cause of decreased ocular function at high altitude.

CONCLUSION

This résumé of some of the more important advances made by American ophthalmologists in the past fifty years has been limited in scope because of space. However, sufficient material has been presented to demonstrate the broad field that has been covered by investigators in this country and to show that substantial advances have been made in most of the subdivisions of ophthalmology. No doubt the present World War is interfering greatly with the advance of ophthalmology in other countries, except possibly in so far as plastic surgery is concerned. This places a heavier burden on ophthalmologists in the United States to advance the knowledge of this important field of work.

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FIFTY YEARS OF OTOLARYNGOLOGY

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FIFTY years ago otolaryngology was in its infancy. During the latter part of the nineteenth century Politzer, the nestor of the otolaryngological profession, was in Vienna. Sir Felix Semon developed laryngology in England. In this country, among others, Blake was advancing otology and Bosworth rhinolaryngology.

At that time otolaryngology occupied a very insignificant place in the curricula of our medical schools. There was in medical schools little or no cooperation between the departments of medicine, surgery, pediatrics and otolaryngology. Perhaps the greatest advance during the past fifty years has been the intimate contact that has developed in our medical schools between the other clinical departments and otolaryngology. This, together with the realization that otolaryngology is only a subdivision of medicine and surgery and cannot make progress independent of these, has had much to do with the development of this specialty. Today anatomy, pathology surgery, medicine and pediatrics constitute the foundation for otolaryngology.

Undergraduate courses in this subject have become much better. Fewer hours are devoted to the subject than fifty years ago but the time is much better utilized. Fifty years ago the undergraduate course had as its object to teach the student to treat patients with otolaryngological disorders. The small number of specialists, the sparsely settled communities, with poor roads and the country doctor, necessitated this.

Today the principal function of the undergraduate course is to prepare the student for otolaryngological work during his undergraduate ward service and particularly to form a foundation for his work during his general internship.

The exigencies of the situation have been met by the great increase in qualified otolaryngologists, increase in population, hard surfaced roads, the automobile and county hospitals.

The graduate work in otolaryngology in this country fifty years ago was mediocre. At that time Vienna was the mecca for graduate students from the United States and Great Britain. There were a few graduate courses in otolaryngology in America, where the whole subject was taught in a few weeks. In England there was abundant opportunity to work in out-clinics but there was little systematized teaching, and there were very few residencies.

After the World War the American Otological, Rhinological and Laryngological Society appointed a committee to study undergraduate and graduate teaching of otolaryngology. This committee functioned for a number of years and aided very much in the development of otolaryngology. The American Academy of Ophthalmology and Otolaryngology established a teachers' section. This met once a year. All important otolaryngological teaching problems were debated. This section still exists, the attendance is large and it has helped and is still helping in the development of the undergraduate and graduate teaching of this subject.

The greatest influence on the development of otolaryngology was, and now is, the American Board of Otolaryngology. It was created in the early part of the twenties. Its initial membership consisted of two members from the American Otological Society, two from the American Laryngological Association, two from the American Academy of Ophthalmology and Otolaryngology, and two from the Ear, Nose and

Throat Section of the American Medical Association. All members serve on the board without remuneration and all are outstanding teachers of otolaryngology. The purpose of the board is to certificate those otolaryngologists who in their judgment are good otolaryngologists. The certificate indicates to the medical profession and the public the proficiency of the holder of the certificate. In order to determine this examinations are held at least twice a year.

A careful study of the credentials of each candidate is made before he is admitted to examination. The examination is divided into four parts; clinical, written, didactic and pathological.

All hospitals with residencies in otolaryngology and all medical schools with graduate courses in otolaryngology have been unconsciously stimulated by the work of the Board and are making efforts to see that their graduates not only meet the requirements of the Board but also pass the examinations. The Board has been an important factor in the development of graduate teaching of otolaryngology. Over two hundred candidates are examined yearly.

Due to the work of the American Board, the hospitals and medical schools, the graduate teaching of otolaryngology in the United States has become the best in the world. Courses in the basic sciences of otolaryngology are given. The purpose of these courses is to prepare the individual for a residency in otolaryngology. In some instances the hospital staff gives to its residents courses in the basic sciences. The otolaryngologists who are educated today are well trained. Fifty years ago we had to travel and to work hard both at home and abroad to secure training which was far inferior to that given in all parts of the United States today.

Research work in otolaryngology in this country is the very best. Mosher, Crow, Proetz, Fenton, Bunch, Schall, Furstenberg, Fowler, Hilding and a host of others are aiding in its advance.

The advances in medical education and the research work have made a wonderful change in otolaryngology in fifty years. Fifty years ago many physicians were general practitioners today, otolaryngologists tomorrow. The change was indicated by a new sign hung over the door or printed on the window. Many of these physicians were sprayers of the nose, a procedure which has been almost wholly discarded.

The surgery of otolaryngology was not developed. Acute suppurative mastoids were drained only if the condition of the patient was critical. I know of one prominent surgeon in a State Medical Society Meeting defending the use of boric drops in the ear over a long period for chronic suppurative otitis media, rather than drainage of the purulent pocket.

Surgery of the ear, nose and throat developed during the early part of the last fifty years. Much of the groundwork for surgery was laid by Zuckerkundl's work in the anatomy of the nasal sinuses. This was done during the last part of the nineteenth century. The work of Onodi, particularly on the nasal sinuses in children, in 1908, was an important factor. Sir St. Clair Thomson contributed to laryngology throughout the past fifty years.

In 1913, Kerrison produced a Textbook of Otology. This was the best one published in English up to that time. This had much to do with the advance in surgery of the ear.

Shambaugh, with his work on the anatomy of the ear, contributed much to aural surgery.

Barany did much to improve our knowledge of labyrinthine conditions.

The radical operation for chronic suppurative otitis media was introduced in this country. Unfortunately in the beginning it was done too often, both in this country and abroad. Surgery of the ear and nasal sinuses was too radical during the first twenty-five years of this century. At this time far more conservative procedures are in vogue. An understanding of allergic sinusitis has prevented many operations.

Among others Mosher, Jackson and Sluder have had much to do with the development of otolaryngology in America during the past fifty years. Mosher, the rhinological anatomist and clinician, was responsible for many new surgical procedures on the nose, nasal sinuses and neck. Sluder, the physiologist, clarified the subject of nasal headaches. Jonathan Wright made great strides in otolaryngological pathology. Jackson, the technician, perfected instruments and technic that made bronchoscopy and esophagoscopy so easy that the majority of laryngologists become proficient in this field.

It is impossible to mention even the outstanding otolaryngologists of America during the last fifty years. Dwyer brought the intubation tube into general use, saving innumerable lives. Allergic study of patients, diatetic treatment, outdoor exercise and the use of vaccines produced satisfactory results in many otolaryngological cases without resorting to operation.

The work of Proetz and Hilding has had a nihilistic effect on the use of drugs and sprays in the nose. The treatment of nose, throat and ear disease fifty years ago was more or less empirical; today it is based on a sound physiologic and pathologic basis.

Otologists during the last fifty years were not content to develop the pure clinical side of the subject but they made great progress in the management of the deafened child and the correction of speech defects.

Itard, in 1802, made the first scientifically logical accomplishment in the field of auditory stimulation for the improvement of hearing in the deafened child with a remnant of hearing. Toynbee followed in the footsteps of Itard. Currier, in New York, and Gillespie, at the Nebraska School for the Deaf, developed this educational procedure during the latter part of the nineteenth century.

In 1893, Urbantschitsch made auricular training practical. Vienna was at that time the center for graduate teaching of otology and many of us worked with Urbantschitsch. I can remember returning to my clinic and interesting one of the graduate students in this subject. She selected a boy twelve years of age, supposed to be deaf, and using Urbantschitsch's technic developed in the boy sufficient hearing to permit him to enter the public school.

Dr. Max Goldstein worked with Urbantschitsch. With the founding of the Central Institute for the Deaf in St. Louis in 1914, he became active in the developing of acoustic exercises for the deaf. He has been largely responsible for the development of the science of re-education of the deaf in this country.

Hudson Makuen, Goldstein and others developed the science of the correction of speech defects. Otolaryngologists during the past fifty years have done much in the rehabilitation of the handicapped child.

FIFTY YEARS OF THORACIC SURGERY*

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ANESTHESIA, asepsis and antisepsis gave the surgery of fifty years ago a firm foundation upon which to build. Thoracic surgery, of course, shared in the stimulus these three great discoveries gave to experimental and clinical surgery but the advance of thoracic surgery was necessarily held in abeyance until roentgenology was discovered in 1895 and, to a less extent, until bronchoscopy, esophagoscopy, thoracoscopy, bronchography and respiration under differential pressure were still later made available.

These tools are now used almost daily in every active thoracic surgery clinic and are rightly considered as indispensable. While reading many case histories of fifty years ago, I was constantly aware of the overwhelming difficulties the clinicians of that time faced in attempting to determine the nature, size and exact position of intrathoracic lesions without the use of roentgenology and bronchoscopy; and it is not surprising that the scope of thoracic surgery was then greatly limited and that the clinical results were shockingly bad when judged by present-day standards. The difficulty of exact localization of a small or even medium-sized pulmonary abscess for surgical drainage by physical signs alone, without the aid of roentgenology, is apparent to the innumerable surgeons who have experienced difficulty in localizing small abscesses even with the combined use of physical signs, *x*-ray and bronchoscopy. The problems presented in an attempt to remove an intrabronchial foreign body without the aid of bronchoscopy or roentgenology may readily be appreciated.

So great were the obstacles to progress from the groping thoracic operations of fifty years ago that DeForest Willard, an American, wrote of "the extreme inherent difficulties and dangers which must be met in our attempts to invade the thorax," and Taeufert, a German, asserted that surgeons were well aware that most operations in the chest, perhaps with the exception of empyema operations, will give only limited results, while Stephen Paget, an Englishman, introduced a book, "The Surgery of the Chest," which he published in 1896, by saying that the time was ripe for the presentation of the valuable facts he had collected "because there are signs that we have reached a stage in this portion of our art beyond which, on our present lines, we cannot advance much further." Manning wrote in 1894, "The lungs were among the last [internal organs] to receive systematic treatment by operations" and he added that such operations were few, having followed experiments on animals or having been undertaken as a last resort in incurable cases. Only William LeMoyne Wills, professor of descriptive and surgical anatomy at the University of Southern California, among the authors whose writings of fifty years ago I have read, expressed an optimistic opinion about the future development of thoracic surgery, predicting that with improvements in surgical methods the successful partial lobectomies he carried out experimentally on animals would, within ten years, be justifiable in man and that they would be as successful as ovariotomy, when performed by competent surgeons.

It is of interest that fifty years ago (1890) David W. Cheever published an article, "Old and New Surgery," in the Boston Medical and Surgical Journal, in which he discussed with justifiable satisfaction the great surgical progress that had been made

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during the preceding fifty years. He spoke with gratitude of the boon of anesthesia and antisepsis, which had been introduced during that fifty-year period, and of their enabling a surgeon to operate without haste and without fear of the terrible consequences of a gravely infected wound. He pointed out the frequency with which pyemia, phlebitis, erysipelas and prolonged wound suppuration followed the operations of that earlier period, the frequent necessity of amputation for infected compound fractures, and the use of a stab incision for the division of a constricting hernial ring because of the virtual certainty that an open dissection would cause suppuration.

The tremendous progress that has been made in thoracic surgery during the last fifty years is indicated by the limited scope of the surgery of the chest at the beginning of this period and the fact that now virtually every disease affecting the chest has been successfully operated upon. When the American Journal of Surgery was established fifty years ago thoracic surgery was limited to the treatment of injuries, pleural and pericardial empyema, necrosis of bone, abscess of the lung, neoplasms of the thoracic wall, drainage of tuberculous cavities and hydatid cysts, dilatation of esophageal strictures and the removal of intrabronchial foreign bodies.

The advances that have been made during the last fifty years in the whole field of the medical sciences have been of particular service to thoracic surgery, enabling it to solve problems that had scarcely been seriously considered fifty years ago. The results of treatment of every surgical disease of the chest have been vastly improved during this fifty-year period. Only did the management of empyema begin to approximate the modern treatment of this condition.

EMPYEMA

The articles published in 1890 and 1891 reveal a strong body of opinion opposed to the then recently prevalent practice of not interfering with an empyema, in the hope that spontaneous absorption of the pus would occur, and an almost equally strong body of opinion opposed to the indefinitely prolonged needle aspiration of pus.

Although the diagnosis of empyema was largely based upon the ascultatory and other well known methods of physical examination, several physicians published pleas for the frequent early use of exploratory needle aspiration as a diagnostic measure in doubtful cases, rightly reasoning that early diagnosis and the early institution of adequate treatment would greatly improve the end results. Goggans, an American, cited his own experience of 168 aspirations of the pleural cavity for a variety of purposes, without ill effect. He aspirated one empyema seventy-three times before he realized that tube drainage was necessary!

As long as fifty years ago several surgeons recognized the fundamentally important fact that needle aspiration of the pleural fluid during the early days of an empyema gave time for the formation of firm pleural adhesions at the limits of an empyema cavity that had been reduced in size by the aspirations. When surgical drainage was carried out after these adhesions had formed, only a localized abscess cavity, not the entire free pleural cavity, was opened. Early drainage of an infected free pleural cavity is notoriously dangerous and is likely to lead to chronic empyema. These sound principles were largely lost sight of until they were firmly established on experimental grounds and well publicized at the time of the World War by the Empyema Commission of the United States Army, of which Commission Evarts A. Graham was the chairman.

In the early 1890's, as in 1940, there was little agreement as to the best type of surgical drainage and, incidentally, there was much discussion as to whether antiseptic irrigations were valuable or dangerous. A few surgeons advocated only intercostal incision. In this country many advocated the use of a tube in an intercostal incision, while abroad the majority of surgeons pre-

ferred the resection of a part of a rib followed by tube drainage. In Germany there was strong support of Bulau's water-seal tube drainage through an intercostal incision, although some surgeons complained of the frequency with which the small tube became occluded by fibrin and débris. One surgeon held open a drainage wound with hooks that were kept taut by an attached rubber tube passed around the chest.

In order to determine the lower posterior limit of an empyema, Kuster made a small anterior incision through which he probed the cavity for the best site for dependent drainage, but the simpler method of determination of this site by aspiration was already known, as was the fact that a postoperative elevation of the diaphragm might occlude a drainage tube that had been placed too low.

With regard to the treatment of tuberculous effusions and empyemas there was no unanimity of opinion and no conception of the fact that different types of empyema required different forms of treatment. Chronic tuberculous and nontuberculous empyema was often well handled by an Estlander or Schede type of thoracoplasty if prolonged adequate drainage had failed to bring about a cure.

Although certain writers of fifty years ago understood some of the principles of treatment of empyema, only Rickman Godlee of England, among the authors I have read, seems to have understood the disease so well that he managed his cases of empyema much as we do today. We now recognize the importance of early diagnosis, and of aspiration until firm adhesions have formed which localize the pleural abscess. We then resect a portion of a rib at the bottom of the empyema cavity, usually in the posterior axillary line, and make an incision through the bed of the rib only large enough to admit snugly a tube as wide as one's thumb, the outer end of this tube being placed beneath water in a jar. If this air-tight, negative-pressure type of drainage does not soon cause expansion of the lung and complete obliteration of the cavity, an increase in the negative pressure by means of a pump is likely to do so.

PULMONARY ABSCESS

The difficulties involved in distinguishing pulmonary abscess from bronchiectasis or empyema with bronchopleural fistula, and in exactly localizing an abscess, before *x*-rays were available, as well as the relatively primitive surgical technic used, made the surgical treatment of pulmonary abscess very unpopular. Among those surgeons who collected the records of the known cases of surgical drainage, Runeberg, a German, found the largest number —forty. Fewer than half of these patients were cured or improved. Willard found the outcome had been successful in six of thirty collected cases; Slawyd found three recoveries among thirteen cases and Seitz four among nineteen. Gaston wrote in 1890 that there were thirty-six cases on record and that "When S. Seabury Jones encountered his first case nine years ago, he was unable to find any reference to the subject whatever in any of the text books. His second case was observed in 1886."

The effect of the difficulty in exactly localizing an abscess was to postpone drainage until the patient had become septic or until the abscess had become so large that it could be readily localized by aspiration. At this time the prognosis was obviously bad in a great majority of the cases. Localization and drainage of secondary abscesses were rarely, if ever, undertaken. Godlee stated that (in such late cases) surgical drainage produced improvement only to a certain point and that hemorrhage, cerebral abscess or other complications might then occur, or that the patient would have to use a drainage tube indefinitely.

Godlee recognized the danger that a diagnostic aspiration might cause an empyema if pleural adhesions were not complete at the site of the aspiration. He recommended the suturing of the lung to the thoracic wall if adhesions were not found at the time of operation.

The technic of drainage was variously performed. With or without the resection of a part of a rib, needle aspiration was followed by the introduction of a scalpel, trocar or other instrument into the abscess. A tube was then introduced into the abscess, perhaps after enlargement of the track with a finger or forceps.

Probably the greatest advance made during the last fifty years in the treatment of pulmonary abscess was the accuracy of diagnosis and localization made possible by *x*-rays. This accuracy has increased to the present time with the widening appreciation of the value of lateral and oblique, as well as postero-anterior, projections of the *x*-rays that has occurred. Bronchoscopy has made an important contribution to the determination of the segment of the lung occupied by the abscess, and in the detection of foreign bodies, bronchial neoplasms and other forms of bronchial occlusion, which are not rare etiologic agents.

Bronchoscopy and postural drainage have proved successful in the nonsurgical treatment of a small group of patients and, through the teaching of Neuhof, increasing recognition has been granted to the value of very early surgical drainage of a pulmonary abscess in which a brief trial of nonsurgical measures has failed. Accurate localization makes possible adequate drainage after the removal of a short segment of only one rib and, as pleural adhesions are often present where the abscess is most superficial, a one-stage operation is often possible. These recent advances in diagnostic methods and surgical technic have improved the results of treatment tremendously.

PULMONARY TUBERCULOSIS

Fifty years ago the treatment of pulmonary tuberculosis was fumbling and wholly inadequate. The sanatorium principle had been proposed but not widely adopted. Koch had recently discovered the tubercle bacillus and there was great enthusiasm over the possibility of a cure of the disease with tuberculin. Inhalations of chlorine gas, insufflations of chloride of gold and sodium and subcutaneous injections of iodoform or creosote were variously tried. Weak solutions of tincture of iodine, carbolic acid, silver nitrate, corrosive sublimate, salycilic acid and other chemicals were injected directly into tuberculous lungs, or into tuberculous cavities after aspiration of their contents. Some physicians found such treatment useless, while others found occasional symptomatic improvement.

Mosler, in Germany, and de Cérenville, in Switzerland, revived an interest in the surgical drainage of tuberculous cavities but, apart from a few cases of symptomatic improvement, the results proved to be disappointing. During the last few years relatively good results have been obtained from drainage (by direct incision or by a catheter introduced by means of a trocar and cannula) of certain types of cavity, particularly that in which the draining bronchus has become obstructed.

During the last fifty years the greatest advances in the treatment of pulmonary tuberculosis have been through the universal adoption of collapse therapy and of the sanatorium, and through efforts to supply a sufficient number of sanatorium beds to meet the demand for them. Although Forlanini's first publication recommending pneumothorax appeared in 1882, and de Cérenville's report of his first "relaxing thoracoplasties" appeared in 1885, an active interest in collapse therapy did not arise until approximately thirty years ago. The first extensive thoracoplasty, that of Brauer and Friedrich, was performed in 1907; the improved Wilms-Sauerbruch modification was introduced in 1911; the modern type of thoracoplasty was not performed until 1928.

Open thoracotomy for the division of offending pleural adhesions in cases of pneumothorax was proposed by Friedrich in 1908, and the operation of closed intrapleural pneumonolysis by means of a thoracoscope was introduced by Jacobaeus in 1913. Paralysis of the diaphragm

through operations on the phrenic nerve was introduced by Stuerz in 1911. Tuffier, in 1893, performed an extrapleural pneumothorax operation, which was sporadically repeated by others until the operation was revived without enthusiasm by Nissen in 1931, and with enthusiasm by Monaldi in 1933. The extrapleural separation of the lung from the thoracic wall and the filling of the space created between them with gauze was carried out by Sarfert in 1901; Tuffier used a filling of a free fat graft in 1910 and Baer used a paraffin mixture in 1913.

A sound knowledge of the effect of these operations upon the different types of tuberculous lesions was acquired slowly, as was a proper evaluation of the inter-relationship between the different operations, and their usefulness or limitation in the management of bilateral lesions. Only during the last ten or twelve years has collapse therapy been used in the leading sanatoria of the world with a full appreciation of its value and limitations, and with the production of astonishingly good results. The number of patients so treated has been too small, in relation to the total number of patients treated for tuberculosis, greatly to affect the tuberculosis death rate. It is probable that the death rate will be greatly reduced when all sanatoria use collapse therapy with maximal efficiency.

THORACIC WALL NEOPLASMS

Operations on thoracic wall neoplasms were performed rather frequently fifty years ago. Little mention was made of benign lesions and, apparently, most were sarcomas. The successful removal of some huge tumors of the ribs or sternum was reported, as well as a considerable number of surgically fatal cases. Among the articles of that period, I note that the surgeons often used an open drainage tube in the thoracic wall after an operation that opened the pleural cavity for an uninfected lesion, and I suppose that some of the deaths were due to a "sucking pneumothorax" that resulted from the presence of the tube. A better understanding of thoracic physiology has led to the tight closure of such wounds or, if drainage should be necessary, to the use of an air-tight, water-seal drainage system. The greatly improved results that have been produced in recent years in the treatment of neoplasms of the thoracic wall have been due not only to the technical improvement just mentioned but to the early diagnoses and operations that the universal use of the roentgen rays has favored.

INTRATHORACIC NEOPLASMS

The difficulty of diagnosis of intrathoracic neoplasms before the first clinical use of the roentgen rays in 1896, and of bronchoscopy and esophagoscopy still later, had the effect of making the surgical treatment of such lesions relatively rare. Diagnosis depended upon the clinical history, physical signs and needle aspiration. The material recovered by aspiration, whether solid or fluid, might lead to a diagnosis. Little was published about neoplastic tumors of the lung and mediastinum and there was a general feeling that the great majority were either sarcomas or carcinomas, for which surgical success would be only a matter of luck, and the only routine treatment for which was the aspiration of a complicating pleural effusion. The drainage of an occasional dermoid cyst was reported and, incidentally, hydatid cysts were operated upon with relative frequency. About fifty years ago Phillips collected 138 cases of hydatid cyst of which thirteen were operated upon with nine recoveries and four deaths; he found that almost all those not operated upon, or merely aspirated, died.

In an 1892 issue of the British Medical Journal, Rickman Godlee wrote as follows: "Amongst a good many cases of cancer of the lung or mediastinum, I have never yet met with one that at all suggested the possibility of removal by operation. Such operations have, however, been suggested, but the circumstances under which there can be even a chance of success must be

exceedingly rare; and thus—although, in animals, portions of lung may be ligatured off and removed without producing any very serious symptoms, I do not think this is at all a promising branch of surgery" and, in 1894, J. A. Manning wrote, "Tumors, which are so eagerly attacked everywhere else, are respected when they involve the lung, save only those with fluid contents." In 1883, however, Kröenlein successfully removed a portion of a lung containing a walnut-sized recurrent sarcoma six months after having resected the huge primary tumor from the thoracic wall, and in 1891 Tuffier successfully resected the apical portion of a man's lung for a tuberculous lesion. Several indirect references were made during this period to the successful removal of the traumatically herniated portion of a lung. William LeMoyne Wills, of Los Angeles, learned from W. W. Keen, Roswell Park, Senn and Fenger in 1892 that none of them had ever removed a part of a lung, except in cases of traumatic pulmonary herniation, abscess "or similar condition."

A number of surgeons occupied themselves fifty years ago with the experimental removal of portions of a lung. Bogliano, Patek and Sailer, of Philadelphia, undertook to remove whole lobes from dogs but the animals died from gangrene of the stump and empyema. They succeeded, however, in three partial lobectomies and one total lobectomy by drawing the part of the lung to be resected out of the chest through a very short intercostal incision and suturing the stump of the resected part in the intercostal incision. Tuffier's experiment, reported in 1891, is especially noteworthy. In a dog he resected two-thirds of the superior lobe of the right lung and six days later one-third of the superior lobe of the left lung, suturing the stumps into the incisions in the intercostal muscles. He killed the dog seventeen days after the first operation and found complete pleural adhesions around the right-sided stump and complete, but less well organized, adhesions on the left side; no pneumothorax remained, the thorax being completely filled by the remaining portions of the lungs.

At approximately the same time Quenu and Hartmann proposed, on the basis of human cadaver experiments, the paravertebral resection of two-centimeter lengths of the third, fourth and fifth ribs as affording a better surgical approach to lesions in the dome of the thorax than the usually proposed infraclavicular incision. Although this incision had not then been used in man, it has been rediscovered a number of times during the last fifty years. A still greater contribution to the future successful surgical management of intrathoracic neoplasms and other conditions, was the report by Tuffier and Hallion, in 1896, of their animal experiments in preventing collapse of the lung by the use of chloroform insufflation through an intratracheal tube introduced through the larynx. They found that this procedure enabled them to operate on the esophagus, vagus and sympathetic nerves and other intrathoracic structures without upsetting the pulmonary circulation. This discovery is one of the vitally important foundations upon which the successes of modern thoracic surgery have been built, and yet it was not put to clinical use until many years later.

The first successful removal of an entire lobe of a lung in man was accomplished by Körte in 1907. The patient was suffering from bronchiectasis; Körte first removed the right lower lobe and, as pulmonary secretions continued, later removed a part of the right middle lobe and the patient made a complete recovery from his disease. Another dramatic advance was made in 1931 when Nissen, of Berlin, successfully removed an entire bronchiectatic lung; the second successful total pneumonectomy was that of Cameron Haight, of Ann Arbor, in 1932. The following year Evarts Graham was the first successfully to remove an entire lung for carcinoma; the patient is now, more than seven years after the operation, well and free from any evidence of recurrence. Graham's successful case represented the first curative treatment of

cancer of the lung in the history of medicine and during the last seven years has hugely stimulated an interest in the early diagnosis of cancer of the lung.

While the removal of benign and malignant neoplasms of the lung and mediastinum was a great rarity fifty years ago, it is a commonplace occurrence today in active thoracic surgery clinics, where the mortality rate is surprisingly low and the percentage of cures high. Such an advance has been made possible by the use of diagnostic roentgen rays, endoscopy, differential pressure anesthesia and, importantly, a proper appreciation of thoracic physiology in relation to the preoperative, operative and postoperative care of patients requiring large intrathoracic operations.

HEART AND PERICARDIUM

Fifty years ago a number of successful cases of aspiration of, or drainage of, effusions or empyemas of the pericardial cavity were reported and J. McF. Gaston wrote, "Surgery has thus, with impunity, invaded the citadel of life." F. P. Porcher, however, complained that, "Throughout the country a vast number of cases [of pericardial effusion] escape detection and treatment, either medical or surgical." Unfortunately this is still true today, in spite of the advent of the *x*-ray, because a pericardial effusion or empyema is often not thought of as a complication of a serious illness and is not recognized until an autopsy is performed.

Although fifty years ago pathologists had found evidence of healed wounds of the heart, I know of no record of that time in which suture of a cardiac wound had been attempted. Roberts made a strong plea for the making of an attempt but Paget ex-expressed his opinion that suture was not practical because, he believed, small wounds do not need suture and large ones would kill the patient before suture was possible. Rehn, however, in 1897, successfully sutured a cardiac wound in a man who apparently was about to die. In succeeding years a large number of wounds have been successfully sutured in patients desperately ill of loss of blood or cardiac tamponade.

Dramatic advances, such as were not dreamed of fifty years ago, have been made in cardiac surgery during recent years. In 1923, Elliott Cutler divided the two leaves of a stenotic mitral valve. Although this operation has never been successfully repeated, Cutler's first patient survived the operation, was clinically improved and lived for several years. A considerable number of successful pulmonary embolectomy operations have been reported since Kirschner's first successful case in 1924. Sauerbruch, in 1931, resected an aneurysm of the right ventricle, "the size of a child's head," and three and a half months later the patient appeared to be entirely well. A large number of cures of constrictive cardiac disease by the operation of pericardiectomy have been produced during the present century. The experimental and clinical work of Claude Beck during recent years in coronary disease and cardiac contusion is outstanding; as is well known, the various operations he has devised in order to improve the blood supply of the myocardium, has given great relief to a number of patients suffering from grave coronary occlusion. The successful ligation of a patent ductus arteriosis by Gross and Hubbard, in 1938, was soon followed by a considerable number of similar successful operations by Jones and Dolley, and by others.

FOREIGN BODIES IN THE BRONCHI

Before *x*-rays were available the localization of foreign bodies, especially those in the bronchi, was difficult and inaccurate, being dependent upon physical signs and, at the time of operation, upon palpation by probing. Fifty years ago, before bronchoscopy became available, the removal of those foreign bodies that could be localized was obviously difficult and the attempt frequently failed. As some foreign bodies can be expelled either through the rima glottidis or through a tracheotomy incision, and as some patients with bronchial foreign bodies

are not acutely ill, there was an inclination not to attempt removal unless the situation was desperate, or at least until pneumonia, or pulmonary abscess or gangrene seemed imminent. Removal was undertaken by means of various types of forceps, hooks and spoons introduced through a tracheotomy incision. In one case a long corkscrew was made to engage an impacted cork but its removal proved impossible. DeForest Willard, in 1891, carried out experiments on dogs in order to determine whether it would be feasible to remove intrabronchial foreign bodies by means of a transpleural approach and an opening of the bronchus in the hilum of the lung. He found the risk of severe hemorrhage enormous, and that leakage of air from the incised and sutured bronchus lead to tension pneumothorax after closure of the chest; most of the dogs he operated upon died.

With the advent of *x*-rays and bronchoscopy and the development, chiefly by Chevalier Jackson, of ingenious instruments for the grasping of all sorts of foreign bodies, attempted removal of foreign bodies has become highly successful and safe. When the procedure is carried out before serious pulmonary infection has developed, the patients usually recover completely. Rarely, foreign bodies become lodged in a part of the lung that is inaccessible by bronchoscopy, or become so firmly imbedded by scar tissue in accessible bronchi that they cannot be dislodged with safety. In such cases, the peripheral foreign bodies may be removed by pneumonotomy, but those in large bronchi may require partial or total lobectomy, which may also be required because of a severe complicating bronchiectasis.

ESOPHAGUS

Fibrous or carcinomatous stricture of the esophagus was well managed fifty years ago by bouginage or intubation. As esophagoscopy was not then available, however, instrumentation was carried out in difficult cases through an esophagostomy opening. Obviously, the removal of foreign bodies in the esophagus was infinitely more difficult than it is at present with the aid of *x*-rays for localization and the esophagoscope for direct inspection during the seizure of the object with specially designed instruments.

One of the most fascinating accomplishments of modern surgery was the successful completion of an antethoracic esophagus, built of skin and jejunum, by Herzen, in 1907, for a patient who had an impassable esophageal stricture. Four weeks after operation the patient was able to eat bread, chopped meat, eggs, et cetera, passing these foods through the surgically constructed tube in front of the chest into the stomach.

Another dramatic operation was the successful removal of a cancerous esophagus in 1913 by Franz Torek. The esophagus was divided well below the neoplasm, the lower divided end was invaginated and the neoplasm and upper thoracic esophagus were dissected from the mediastinum and drawn out of an incision in the anterior cervical triangle, where the tumor and redundant esophagus were cut off and the esophageal stump sutured to the skin. In 1925, Torek reported that more than eleven years after operation the patient, then seventy-eight years of age, was all right and happy, and that any food that was cut or chewed into a finely divided state passed through the rubber tube that was used to connect the cervical esophagostomy and the gastrostomy openings.

CONCLUSION

Even the factual narration of the changes in surgical procedure that have taken place in a selected group of thoracic conditions does not adequately express the tremendous advance that has taken place in the practice of thoracic surgery during the last fifty years. The most striking change has not been the improvement in the technic of individual operations but the fact that today operations are being successfully performed in great numbers for almost every disease affecting the thoracic organs, whereas fifty years ago thoracic operations were relatively rare and were limited to the treatment of a very few conditions.

SOME OF THE DEVELOPMENTS IN RADIOLOGY DURING THE LAST FORTY-FIVE YEARS*

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THE specialty of radiology is one of the younger divisions of science. Though it is difficult to assign a beginning to the science of radiology, there is no doubt that the discovery of the roentgen ray by Wilhelm Konrad Röntgen and of radium by Pierre and Marie Curie were the cornerstones. It would be impossible, in the narrow limits of this presentation, to evaluate properly these discoveries. Such a task would include a careful study of the work of many scientists. In fact all the apparatus used by Röntgen in his discovery represented the labor of many students and ingenious investigators of the preceding three centuries.

Sylvannus P. Thompson, the well known English physicist, in an address before the newly founded British Roentgen Society, held on November 5, 1897, stated the following:

"November 8, 1895 will ever be memorable in the history of science. On that day a light which, so far as human observation goes, never was on land or sea, was first observed. The observer, Professor Wilhelm Konrad Röntgen. The place, the Institute of Physics in the University of Würzburg in Bavaria. What he saw with his own eyes, a faint flickering greenish illumination upon a bit of cardboard, painted over with a fluorescent chemical preparation. Upon the faintly illumined surface a line of dark shadow. All this in a carefully darkened room, from which every known kind of ray had been scrupulously excluded. In that room a Crookes tube, stimulated internally by sparks from an induction coil, but carefully covered by a shield of black cardboard, impervious to every known kind of light, even the most intense. Yet in the darkness, expressly arranged so as to allow the eye to watch for luminous phenomena, nothing visible until the hitherto unrecognized rays, emanating from the Crookes tube and penetrating the cardboard shield, fell upon the luminescent screen, thus revealing their existence and making darkness visible.

"From seeing the illumination by the invisible rays of the fluorescent screen, and the line of shadow across it, the work of tracing back that shadow to the object which caused it, and of verifying the source of the rays to the Crookes tube, was to the practiced investigator but the work of a few minutes. The invisible rays—for they were invisible, save when they fell upon the chemically painted screen—were found to have a penetrative power hitherto unimagined. They penetrated cardboard, wood, and cloth with ease. They would each go through a thick plank or a book of 2000 pages, lighting up the screen placed on the other side. But metals such as copper, iron, lead, silver, and gold were less penetrable, the denseness of them being practically opaque. Strangest of all, while flesh was very transparent, bones were fairly opaque. And so, the discoverer, interposing his hand between the source of the rays and his bit of luminescent cardboard, saw the bones of his living hand projected in silhouette upon the screen. A great discovery was made."

The discovery of the *x*-rays by Röntgen was not accidental. Popular opinion would have us believe that it was. However, a careful study of the personality and the scientific background of Röntgen as well

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as all of the events that led up to the actual discovery disprove any such theory. Röntgen was one of the outstanding physicists of the nineteenth century. He began his experiments with the cathode rays in October, 1895, and it was because of his ability and his constant search for new phenomena that he ultimately was able to make such a valuable contribution.

Early publications of Röntgen's discovery occurred in this country in the *Electrical Engineer*, New York, on January 8, 1896, under the title of "Electrical Photography through Solid Matter." Other publications occurred not only in this country but in Germany and Italy and it was shortly after these early communications that the medical profession accepted the "new weapon" and promptly used it to good advantage. Röntgen's name and the news of his discovery thus became known throughout the whole world and much progress was made before the modest discoverer spoke for the first time on his "New Kind of Rays" before the Physical Medical Society at the University of Würzburg on January 23, 1896.

Shortly after Röntgen's discovery numerous scientists throughout this country and Europe began to work with feverish activity with the "new instrument" and very early, roentgen laboratories were installed in hospitals, two of the first being the New York Post-Graduate Medical School and Hospital in April, 1896, and in the Hahnemann Hospital in Chicago. Meanwhile new improvements were made especially with *x*-ray tubes and the fluoroscope. In addition to the diagnostic application of the *x*-rays they were soon found to have therapeutic possibilities. Unfortunately in this early period the workers did not appreciate the danger of the rays with which they were working and very shortly began the sad period in which the *x-ray burn* was ushered into being.

Shortly after Röntgen's discovery a French scientist, Henri Poincaré, suggested that it would be worth while to investigate whether rays produced by ordinary fluorescent or phosphorescent substances might be similar to those emitted by an *x*-ray tube. Thus it was that Henri Becquerel undertook a systematic study of some uranium compounds and much to his surprise found rays that would penetrate metal and affect photographic plates. Becquerel presented the results of his investigations on this subject to the Paris Academy of Sciences in January, February, March and November in the year 1896.

It was quite natural, therefore, that other workers should begin investigations on the uranium compounds and other elements that had similar properties, and thus it was that Pierre and Madam Curie noticed that a sample of pitchblende from an Austrian mine showed a higher radioactivity than could be accounted for by its content of either uranium or thorium. Madam Curie logically concluded that the pitchblende contained small quantities of some other substance which was more radioactive than either uranium or thorium and that that substance could not be one of the known chemical elements since she had studied all of the elements known at that time. The two investigators selected pitchblende as the ore for further studies and began to make a careful analysis of the composition of that ore. Finally they obtained a substance which had a strong radioactive content which was associated with a bismuth extract of the ore. They announced the discovery of the substance in July, 1898, and called it "Polonium." Later on they discovered that a barium extract of the ore contained much more radiation. This they called "Radium" and announced the discovery in December, 1898.

Surgery was in its full development at the time of the discovery of the *x*-rays and radium. That was a period in which the revelations of Pasteur and their successful applications by Lister were in full swing. It is quite natural, therefore, that the first utilization of the discovery of the *x*-rays should have been in relation to surgery. The striking feature of the *x*-rays as they

pertained to their early applications in medicine was their power to penetrate tissues in proportion to their density. Thus it became possible for one to differentiate the shadows of soft tissues from those produced by bone. Likewise it was possible to demonstrate the shadows of opaque foreign bodies.

Within a few months it became obvious that *x*-rays not only had the property of penetration and producing an effect on the emulsion of photographic plates but the rays also produced a definite influence on tissue cells, and almost from the beginning investigators interested themselves not only in extending the diagnostic application of the new method but were also studying its effect upon various tissues and organs.

During the first two years the diagnostic use of *x*-rays was limited by the inadequate and fickle types of equipment. It was possible, however, to obtain roentgenograms of fractures of the extremities and bone conditions such as osteitis deformans, gouty deformities, rheumatoid arthritis, tuberculosis of the knee joints, etc. Demonstration of the existence of foreign bodies and, in certain instances, accurate localization thereof was practiced. Later on, as the equipment improved, it was possible to demonstrate kidney stones and gallstones. Early in 1904 pyelography was being practiced by introducing an opaque material into the bladder, ureter and renal pelvis.

The clinician's attention was focused largely on the respiratory tract and the many pulmonary conditions that were so little understood at that time. Likewise, it was possible to study the movements of the heart and its various alterations in size and contour.

During the early period of roentgen therapy investigators became interested in the destructive effects of *x*-rays on various bacteria particularly the tubercle bacilli and those causing diptheria. Many of the reports were contradictory; some investigators believed that *x*-rays would destroy bacteria and others that they would not. Even today the action of *x*-rays upon bacteria in tissues is little understood. It is well recognized that *x*-rays have very little effect on bacteria in culture media but it is known that they do produce profound effects even by very small doses on infections in the soft tissues. It is interesting to note that in 1902 Pusey and Caldwell in their monograph, "The Roentgen Rays in Therapeutics and Diagnosis," state the following: "The fact that organisms and living tissues can be destroyed by exposing to *x*-rays while the same organisms in inert cultures are uninfluenced by *x*-ray exposure, proves positively that it is not the *x*-rays *per se* that causes the destruction, but that the tissues themselves, doubtless under the conditions of activity excited by the *x*-rays, played the important role in the germicidal process."

During the early days of roentgen therapy conditions such as cancer and skin diseases of various kinds were treated with *x*-rays. The operators knew little or nothing of the effects of the "new agent" yet not infrequently were they able to obtain satisfactory results. On other occasions tissue damage was produced. The early investigators became familiar with the skin manifestations produced by long and repeated *x*-ray exposures. These included the so-called sunburn, pigmentation, telangiectasia, atrophy, chronic dermatitis, hyperkeratosis, ulceration, epilation and changes occurring in the finger nails.

Following the discovery of radioactivity and the isolation of the radium salts by the Curies, investigations into the effects of the rays of radium on bacteria, plant life, lower forms of animal life and the various tissues of higher animals were undertaken. The concept that radium might be applied in medicine was conceived following the famous Becquerel burn in 1901, and Pierre Curie, after intentionally producing a similar burn on his arm, loaned some radium to one of the hospitals for the treatment of various skin lesions. Subsequently, through careful investigations of many of the early pioneers, technics were developed for plac-

ing radium in small tubes in order that they might be implanted into tumors and body cavities for varying periods of time. In this country Robert Abbe, of New York, and Howard Kelly, of Baltimore, did pioneer work in developing the field of usefulness for this new therapeutic agent.

The roentgen apparatus for diagnosis and therapy in the early days was quite crude. It included static machines, induction coils and very poorly constructed gas tubes. It was not until 1907, when Snook introduced his "interrupterless transformer" with the cross-arm type of rectification, that there occurred a marked advance in the practical use of *x*-rays. About the same time there occurred improvements in *x*-ray tubes and *x*-ray screens and various electrical and photographic methods were developed for measuring the output of the *x*-ray tubes. In the early 1900's the dangers of exposures to the *x*-rays began to be appreciated and it was during this period that efforts were made to protect the operator and the patient from stray and unnecessary direct radiation. The operator learned by bitter experiences to keep from interposing his hand between the beam of *x*-rays and the patient, but very little if anything was known about the dangers of secondary rays.

The first efforts to make roentgenographic studies of the skull were unsatisfactory but as the machines became more powerful and more trustworthy, brain tumors producing new bone formation or causing erosions of the skull and those having calcium deposited within its tissues were demonstrated.

Shortly after the discovery of the *x*-rays, efforts were made to study the gastrointestinal tract by the use of opaque suspensions. Various types of media were used. By 1904, there was a fairly comprehensive monograph published on the roentgen examination of the digestive system by Rieder. Another phase of investigation concerned the demonstration of gallstones. This was not particularly satisfactory in that very few of the gallstones are capable of being demonstrated by means of the survey roentgenogram of the abdomen.

This period of 1910 to 1920 was featured mainly by improvements in apparatus and technic and these were reflected in a wide extension of the roentgen examinations to numerous phases of clinical medicine. Probably the most outstanding contribution in this period was made to the study of the gastrointestinal tract. Some of the more prominent investigators would include Haudek, Cole and Carman.

There was also a rapid improvement in the roentgen examination of the urinary tract. This was probably facilitated by the development of good, intensifying screens through the efforts of Threlkeld-Edwards. It was during this period that the use of sodium iodide as an opaque medium to be introduced into the urinary tract for pyelography was developed.

The roentgen diagnosis of the chest was particularly improved during this period. Dunham, Pancoast and Baetcher did an excellent piece of work in setting up criteria or standards that they regarded as within the limits of the healthy chest. Chevalier Jackson by the aid of bronchoscopic examinations of the chest was assisting the roentgenologist to recognize conditions produced by foreign bodies and other conditions which up until this time were not well known. Jackson also introduced opaque media such as the dry bismuth subcarbonate into the lung by bronchoscopic insufflation for diagnostic purposes.

The World War brought many new developments in *x*-ray equipment. The demands on the radiologist were largely those concerned with mobile units in the field and in base hospitals.

During the latter part of this decade, through the investigations of Dandy, the procedures of encephalography and ventriculography were developed. Roentgen technics in the examination of the paranasal sinuses and mastoids were markedly improved.

At first the application of roentgen and radium therapy was largely confined to the destructive effect of radiation upon superficial lesions but gradually the radiosensitiveness of different tissues and organs were tested experimentally and the mechanism by which such effects were produced was partly or completely elucidated. With the knowledge that different kinds of cells vary considerably in radiosensitiveness there has developed a steady expansion of radiotherapy. Thus it was discovered that many inflammatory disorders of the skin were amenable to irradiation. Likewise the exceptional susceptibility of leukocytes, especially lymphocytes, and the remarkable action of roentgen rays and radium on lesions such as lymphoblastoma and hyperplasia of the thymus were discovered. It was during this period that the action of the *x*-rays upon the epithelium of the ovary was revealed by the investigations of Albers-Schönberg, Regaud and others. It was through such observations that hemorrhagic conditions and fibroma myomas of the uterus were treated.

Subsequently, researches by Bergonie and Tribondeau yielded the information that young, rapidly growing cells were more radiosensitive than mature adult cells, and this, together with the still more important fact that each variety of cell has specific sensitiveness to radiation, constitutes the essential basis of radiotherapy and explains most of the effects noted at the irradiation.

From 1910 to 1920 methods of determining the dosage or output of *x*-ray tubes were improved. *X*-ray tubes themselves were improved. Radiotherapists began to learn more about the various types of filters. Improved technics in treatment and methods were developed by which the patient could be protected from unnecessary irradiation.

Since the close of the World War the specialty of radiology has widened its boundary and has now rendered a useful service in almost every specialty of medicine. Not only is radiology playing an important role in medicine but it is rendering a real service in other fields such as in industry.

The development since 1920 has been to some extent through new apparatus such as the Potter-Bucky diaphragm, *x*-ray tubes of higher capacities, improved fluoroscopic and intensifying screens, better transformers and a number of special devices for facilitating special procedures. Probably the most important contribution has been through certain discoveries which will be discussed later.

The investigations in the study of the respiratory tract were remarkably developed during the period since 1920. The work of Jackson and Manges in the localization of foreign bodies in the upper and lower respiratory passages deserves special recognition. Further work, with particular reference to the heart and large vessels has revealed information which has improved the radiologist's ability to render more help in the diagnosis of certain heart lesions. There is still much to be done, however, before the roentgen examination of the heart can be of real assistance to the cardiologist. Chest diagnosis has improved particularly with regard to the diagnosis of malignant tumors and bronchiectasis following the use of opaque media such as lipiodol.

Collective studies have been made concerning the roentgen appearances of the various diseases involving bones and joints and at the present time the roentgen diagnosis of deficiency diseases and bone lesions such as syphilis and bone tumors can be made with a certain degree of accuracy. Through the anatomic and pathologic studies of Schmörl and others the roentgen diagnosis of lesions involving the spine has received a great impetus.

The roentgen examination of the urinary tract, both by excretion urography and retrograde pyelography has improved tremendously. The discoveries of Lichwitz, Swick and von Lichtenberg have been a tremendous boon to urology in that it is now not only possible to demonstrate lesions within the urinary tract but it is possible also to study its function following

the administration of one of the uroselectan series. The procedures of ventriculography, encephalography and myelography are being used with increased frequency. Lipiodol instilled into the paranasal sinuses has assisted one in rendering the correct roentgen diagnosis on occasions when it was not possible to make a diagnosis by the conventional examination. The examination of the neck and upper respiratory tract including the pharynx, cervical esophagus, larynx and cervical trachea has been popularized through the collective studies of Hay. Sialography, an injection of lipiodol or some opaque substance into the duct of the salivary gland, is another procedure that has assisted the surgeon.

Roentgen studies in the gastrointestinal tract continue to improve as we learn more about the gastrointestinal physiology. It is now possible to diagnose most organic lesions in the esophagus, stomach, duodenum, small intestines and colon. Not only are opaque media used but certain contrast media such as air or gas are employed with barium sulfate to show the mucosal folds of the various portions of the gastrointestinal tract.

Probably one of the greatest contributions to the diagnosis of gastrointestinal lesions has been through the agency of the Miller-Abbott tube in the diagnosis of intestinal obstructions. This tube renders it possible for one not only to make a diagnosis of an obstruction but also to ascertain the type of obstruction and its location. It also renders it possible for one to decompress the patient so that the operation instead of being an emergency may become an elective procedure.

The roentgenologic diagnosis of the gallbladder received a great boon in 1924 through the method known as cholecystography developed by Graham, Cole, Copher and Moore. The method necessitates the administration of a dye, sodium tetraiodophenolphthalein either by mouth or intravenously. The dye is excreted by the liver, stored by the gallbladder and renders the shadow of the lumen of that organ visible on the roentgenogram. It is now possible, with this method, to diagnose to some degree the function of the gallbladder as well as to demonstrate various abnormalities and diseases of that organ. The ability to demonstrate nonopaque gallstones in many instances has been proved conclusively.

Another procedure that has helped the surgeon in gallbladder surgery is known as cholangiography. This procedure requires the introduction of an opaque oil into the gallbladder and biliary radicals, either at the time of or following operation. It is used to demonstrate whether the ducts are patulous or if there are stones, growths, etc., blocking them.

The field of pelvimetry still seems to be a fertile one for the development of technics to assist the obstetrician in the examination of those patients who may have some dystocia. The procedure of hysterosalpinography has been developed in latter years to an even greater degree, especially, following the work of Sicard and Forestier. This examination requires the introduction of lipiodol into the body cavity of the uterus and into the fallopian tubes, and is used largely to tell whether the tubes are patulous or whether there are any mural lesions encroaching upon the lumen of the uterine canal.

Although arteriography was practiced very early following the discovery of the *x*-ray, it has been developed more recently largely through the perfecting of thorotrast and uroselectan. Uroselectan is being used in increased frequency for demonstrating lesions in the arteries and veins and to some extent in conditions involving the heart and great vessels.

One of the most recent developments in the field of roentgen diagnosis is body section roentgenography. This is not a new procedure as it was described a number of years ago; but largely through the work of Andrews, Kieffer, Moore, Scott and others, and the development of new pieces of apparatus, the procedure is receiving increasing attention. There are a number of indications for the use of body section roentgenography but body section roent-

genograms were not very satisfactory for interpretation until recently.

The development of modern methods of treatment since 1920 in roentgen and radium therapy has been due principally to several things which have more or less complimented each other: First, improved apparatus with a tendency toward increasing the voltage. At the present time there are a number of 1000 kilovolt machines distributed throughout the United States; second, the physical measurements of the *x*-ray tube and machine are now so well standardized that everyone using roentgen therapy throughout the United States should be able to obtain correct information concerning the dosage and output of the *x*-ray tubes, third, the development by physical measurements of isodose curves showing the percentage rate of absorption and scattering in the tissues; fourth, increased information obtained from biologic experiments; and finally, the knowledge derived from the reports of collective studies on various conditions that have received radiation therapy. The radiologist of today is well informed and all physicians should learn that in order to get the most out of this new therapeutic agent there should be close cooperation between all of the physicians managing the care of patients.

The improvement in radium therapy has corresponded to that obtained with roentgen therapy. There have been improved methods in the application of radium. It is now possible to get radium put up in any type of container and there are companies that can send radium to those physicians who know how to apply it anywhere in the United States. The use of radium for the most part has been confined to applications within body cavities, superficial conditions and lesions in which it is necessary to implant radon or platinum radium needles.

During the past few years the intense study of the atom and the atomic nucleus by physicists throughout the world has resulted in contributions of incalculable value to biology and medicine. Perhaps the most important of these developments is the induction of artificial radioactivity in practically all of the elements and a new penetrating form of radiation called the neutron ray. Indeed it seems that because of these discoveries medicine will benefit to a degree similar to that following the discoveries of *x*-rays by Röntgen and of natural radioactivity by Becquerel and the Curies. Some of the discoveries that led to the development of the *cyclotron* include those of Joliot and Curie, son-in-law and daughter respectively of Pierre and Marie Curie, for in 1934 they reported that radionitrogen, radiosilicon and radiomagnesium had been produced artificially in their laboratory. This induced activity resulted when certain elements were bombarded with alpha particles of radium. Prior to that contribution Urey and his associates, in 1932, reported the discovery of heavy hydrogen and finally, in 1936, E. O. Lawrence and D. Cooksie reported the development of a new apparatus for the multiple acceleration of light ions to high speeds by which they could produce large quantities of radioactive elements. This instrument they called the "cyclotron" and in it *deuterons* are accelerated to high speeds equivalent to 5,000,000 volts or more and then directed against targets of various elements which are made radioactive.

Thus it is that during the last twenty years *x*-ray machines have been developed for treatment that varied from potentials of 40 kv. to those in excess of 1000 kv. and finally through the contribution of Lawrence and his associates we have a new instrument, the "cyclotron." At this early period the cyclotron is an unknown, so far as medicine is concerned, but sufficient experiments have been carried out to show that it does have an effect on biologic materials of various kinds, it can produce radioactive isotopes and it does affect the various tissues of the body. In fact there are several cyclotrons being built at this time, some for pure science and others for therapeutic purposes. Again, pure science has made and is making unpredictable but practical contributions to the problems of biology and medicine.

Radiology in this country is barely forty-five years of age yet in that brief period this branch of medical science has made collossal strides. Skinner aptly states that "no other fields of human research has enjoyed such immediate and universal participation, such profound adaptability to problems of human diseases, such extensive availability to the world's population and such benefits to unconquered fields of diagnosis and therapy as roentgen diagnosis and radiation therapy." There have been a number of agencies that have had an influence upon the specialty of radiology so far as education is concerned. These might be listed as follows: (1) The influence of the American Medical Association upon medical education in general. (2) The influence of radiological societies upon medical education. These radiological societies include The American Roentgen Ray Society, established in 1900, The American Radium Society, organized in 1916, The Radiological Society of North America, founded in 1920, and the American College of Radiology in 1923. (3) The influence of the Council on Medical Education and Hospitals of the American Medical Association. For a long time this Council has had an advisory committee which have drawn up "essentials" for admission to the list of physicians specializing in "radiology." (4) The requirements of the Council on Medical Education concerning radiological services in hospitals. Very early the Council set up definite requirements, which were asked of the hospital before it could be approved for training internes. (5) The American Board of Radiology. The American Board along with other specialty boards in this country has set up certain standards which must be fulfilled by those wishing to enter the field of radiology. At present there are in excess of 1000 radiologists who have been certified by the American Board.

In concluding this paper which has been a very sketchy survey of some of the highlights occurring in radiology during the past forty-five years I am of the opinion that attention should be called to the fact that in radiology there is a real opportunity for the ambitious and well trained young physician. The field is fresh, fertile and uncrowded and there are many questions to be answered and avenues to be explored.

It seems to me that an excerpt from an address by Harold W. Dodds, president of Princeton University, is peculiarly fitting: "Plato's immortal allegory of the men seen in a cave was never more appropriate than today. You remember that the unfortunate creatures, representing society in general, were bound in the darkness with their faces to the wall; that there is a fire behind them and that real figures pass between them and the fire, so that the imprisoned men can see the shadows of the figures on the wall, but never the figures themselves, in reality. Occasionally a prisoner is freed from his chains and led above to the daylight where he learns the reality behind the shadows and learns how imperfect were his early impressions. Therefore, it becomes his duty to return to the cave and help disperse the ignorance of his fellows."

Does not this allegory express the opportunity and obligations the radiologist owes to medicine? Is it not our duty, having seen the reality, to train men with the talent, the intellect, and the will to work, so that they, in turn, may be able properly to interpret the shadows in the light of modern physiology and pathology?

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FIFTY YEARS OF ANESTHESIA

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PERIOD OF DISCOVERY AND EMPIRICAL USE

ANESTHESIA was foreshadowed by the discovery of ether, by an Italian, Valerius Cordus, in 1540, three centuries before its *anesthetic* properties were discovered. Oxygen and nitrous oxide were discovered by an English clergyman and scientist, Priestly, in 1774, over seventy years before their use in surgery. Von Liebig, in Germany, Samuel Gutherie, in America, and Souberan, in France, independently, discovered chloroform in 1831, sixteen years before its use as an anesthetic.

Henry Hill Hickman, an English surgeon, in 1820 to 1828, made successful experiments upon lower animals, rendering them insensible to pain, by the inhalation of nitrous oxide or carbon dioxide and the exclusion of air, and then proved insensibility to pain by performing various minor operations on these animals, but his work was treated with skepticism and scorn and he was not allowed to test his theories upon human beings.

The discovery of the anesthetic properties of ether and nitrous oxide was made by observations of a doctor (Long) and a dentist (Wells). They proved that ether and nitrous oxide when inhaled to a point of intoxication, at "Ether Frolics" or "Chemical Lectures," the human subjects were unaware of bruises or painful spots received while in a semi-intoxicated stage.

Dr. Crawford W. Long, of Georgia, in 1842, was the first to use any drug (ether) in a surgical operation, to render the patient insensible to pain.*

Horace Wells, a dentist, in 1844, was the first to use nitrous oxide. His public demonstration was a failure, but he continued to use it in his private practice. W. T. G. Morton, also a dentist, was the first to demonstrate successfully in public (October 16, 1846) the anesthetic properties of ether (suggested by Jackson, a chemist).

Ether for surgery and nitrous oxide in dentistry were quite generally used shortly after their discovery and introduction. J. Y. Simpson, a doctor of Edinburg, Scotland, had used ether quite extensively in his obstetric practice, but the crude use of ether alone with its disagreeable odor, nausea and vomiting was especially repugnant to his patients. From Waldie, a chemist, Simpson obtained chloroform, which he immediately tested upon himself and other doctors. He found it pleasanter to inhale and that it produced the same results as ether. One year after Morton's successful demonstration of ether, Simpson commenced using it in his practice, in 1847, as did others. All anesthetics at this time were used in an entirely empirical manner, as nothing was known of the physiology or possible harmful effects of the substances used.

Simpson was the pioneer and the first physician in history to give an anesthetic for the relief of pain in childbirth. Opposition to this procedure was intense by physicians and clergy as evidenced by the following incident:

Dr. Simpson was called to Windsor Castle to deliver Queen Victoria under the new anesthetic. On his lecture room door, he posted a notice: "Professor Simpson has gone to deliver the Queen." Under this notice, some one, probably a student, wrote, "God save the Queen!" However, Her Majesty was so pleased that she

* The words, *anesthesia* and *anesthetic*, were then unknown. Oliver Wendell Holmes suggested the word (November 21, 1846).

knighted the worthy doctor, thus bestowing upon him the highest honors of the British Government. Tradition and superstition were superseded by the fact that in this notable instance anesthesia was safe in childbirth. In 1847, Flourens, in France, discovered the anesthetic properties of ethyl chloride. Six years later, in 1853, Alexander Wood, in England, invented the hypodermic needle, which made possible local, intravenous, regional and spinal anesthesia.

PERIOD OF SCIENTIFIC ADVANCEMENT

The fundamentals for the scientific advancement of all methods of anesthesia, as we know them today, were thus given to us to experiment with and develop in a scientific manner.

The drop method of inhalation anesthesia was universally used. The patient was placed upon the operating table, and as the second or stage of excitement was reached, he was pinioned down by attendants, until the third stage with relaxation occurred. Then the attendants retired and the patient was prepared for operation. Upon return to bed after the operation, nausea and vomiting were usual and always serious in abdominal operations, and occasionally were fatal. No other form of anesthesia was used at that time.

Dr. Thomas L. Bennett, of New York City, after studying in England (1895), and acquiring the method from Hewitt, of London, developed an apparatus, and introduced the "gas-ether" sequence in America, in 1896 to 1897. Bennett was the first physician in America to devote himself exclusively to anesthesia (1896 to 1932, thirty-six years), although it was customary in England from almost the first discovery of anesthetics.

The "gas-ether" method consisted of a very simple apparatus for getting the patient under nitrous oxide first, then switching gradually to ether and continuing the anesthetic with ether, thus eliminating attendants, the second stage and, to a great extent, nausea and vomiting. This method was so obviously an improvement upon the "open" or drop method of giving ether that it was universally adopted.

A familiar saying of Bennett's was that he had given "over thirty thousand (30,000) anesthesias without a death." But not everyone who gave anesthetics had the natural and acquired skill of Bennett and surgeons began to experiment with other agents and methods. The foundation of local and spinal anesthesia was the discovery in 1858 of the alkaloid of cocoa leaves, by Albert Niemann. Scraff discovered the analgesic properties of cocain when placed on the tongue. Carl Kohler (1884) demonstrated its anesthetic value when placed in the eye. William Stewart Halstead and James A. Corning gave clinical demonstrations in 1885 of its value. "Spinal anesthesia largely replaced local anesthesia for operations below the diaphragm." (Hertzler, in "Local Anesthesia.")

Local anesthesia rapidly advanced with the introduction of novocain, which was discovered by Einhorn and was first clinically tested by Braun in 1905. It is from seven to ten times less toxic than cocain, its solutions stand boiling and keep without deteriorating for a long time. Its action is increased and prolonged by the addition of adrenalin. Its derivitives are even less toxic and more suitable in every way than novocain.

A method of combining local and inhalation anesthesia, was developed by Crile and Lower of Cleveland, in 1920. The method is known as *anociation*, and when combined with preliminary medication, prevents fear, pain, shock and postoperative nervous manifestations. A minimum of each anesthetic is used, and the patient gets the benefit in increased safety and comfort.

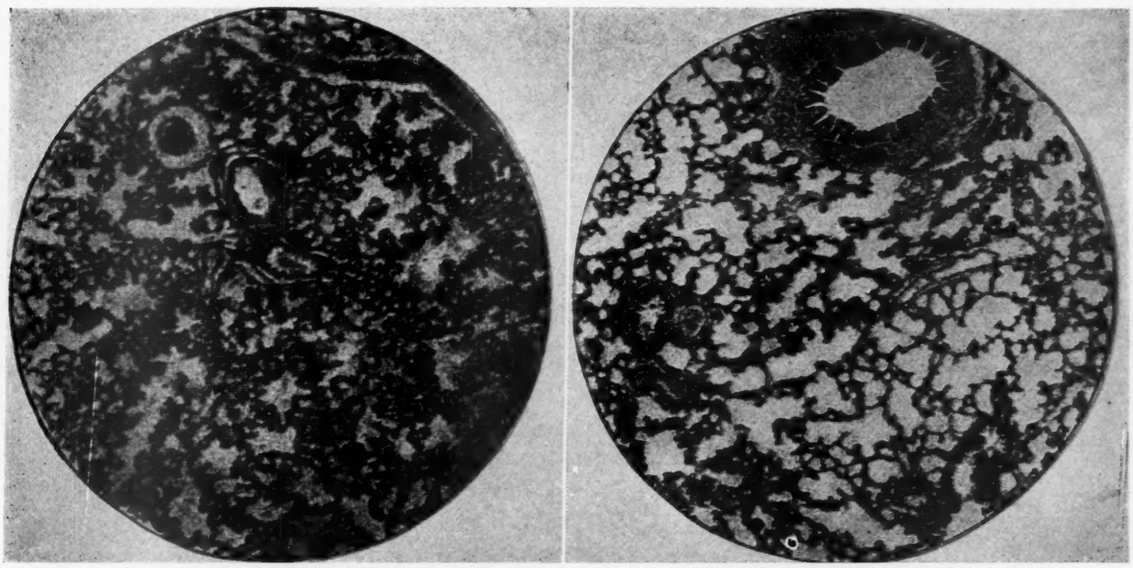
INTRAVENOUS, SPINAL AND LOCAL ANESTHESIA

Research by laboratory workers has produced such definite results for intravenous, spinal and local anesthesia that, together with the increased knowledge and skill of the surgeons, relief from pain is as safe and

certain with these drugs, as with inhalation anesthesia. "The dangers of spinal anesthesia lie with the user more than the drug." (Babcock-Maxson, in "Spinal Anesthesia.")

Dr. James F. Mitchell, a surgeon in Washington, D. C., by his writings and skill in the use of the needle, has done much to promote the use of local anesthesia. The author has seen Dr. Mitchell do operations in his office under local agents that would usually be performed in a hospital under an inhalation anesthetic.

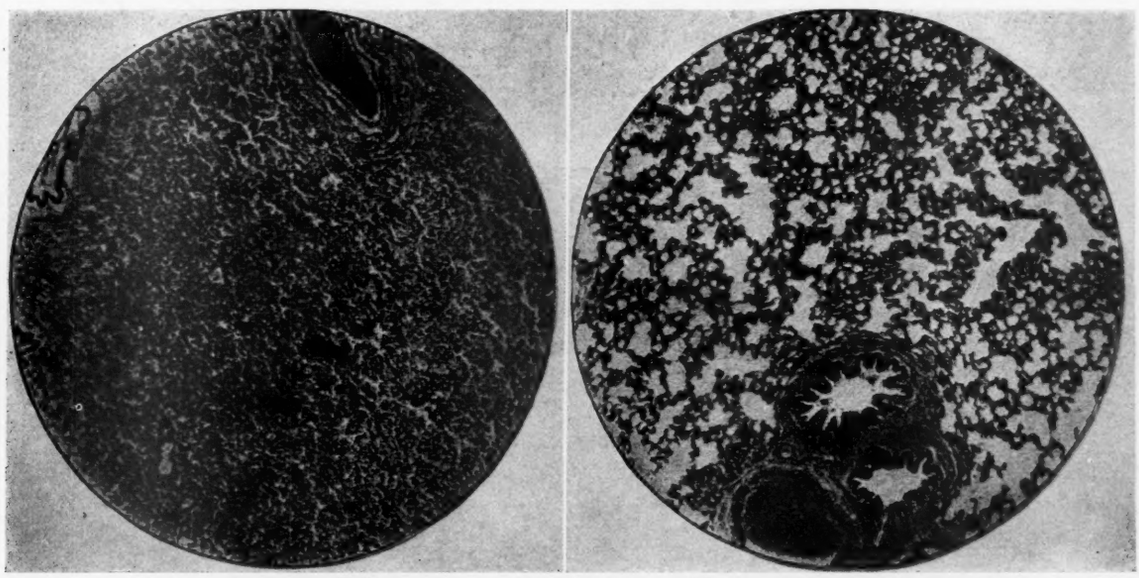
Professor Gaston Labat, of New York University, was the outstanding teacher of regional and spinal anesthesia, of his day.



Nitrous oxide 93 per cent, oxygen 7 per cent.

Fig. 1. No preliminary medication. Air spaces filled with edematous fluid; perivascular edema; congestion.

Fig. 2. *Preliminary medication.* Air spaces and bronchi clear; no perivascular edema or congestion.



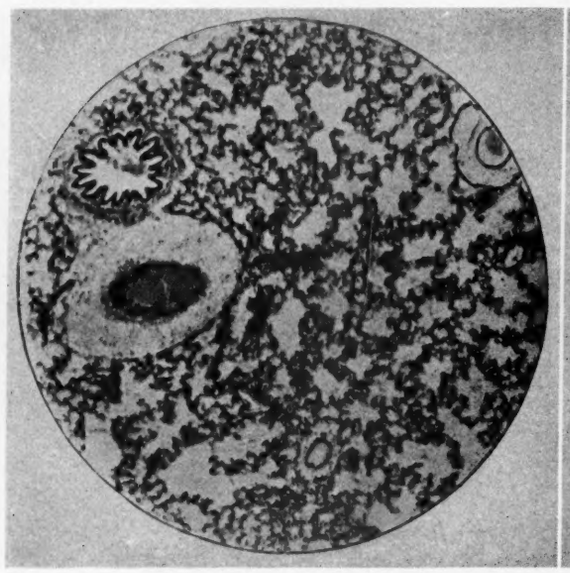
Ether vapor 34 per cent, oxygen 66 per cent.

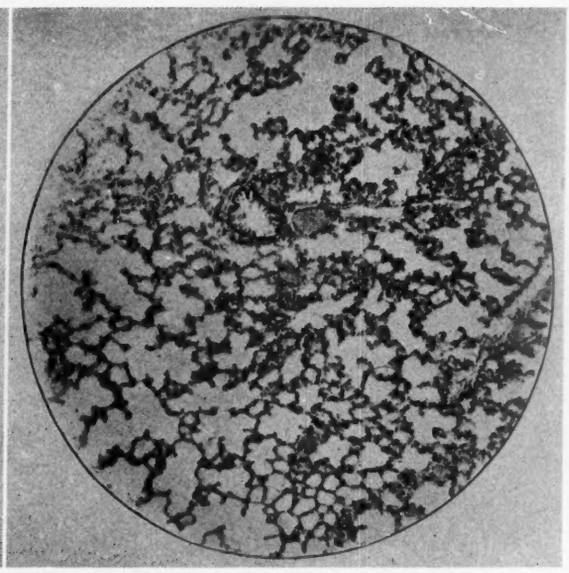
Fig. 3. No preliminary medication. Massive atelectasis and congestion; air spaces obliterated.

Fig. 4. *Preliminary medication.* Lung tissue relatively normal.

The work of Charles W. Hooper, assisted by the author. From Autochrome photomicrographs in Nelson's Looseleaf Surgery, Vol. 1, page 514.

Professor Babcock, of Temple University, Philadelphia, in his textbook on Surgery (1938), reported ten thousand (10,000) prefers spinal anesthesia (using procain), and uses it exclusively in obstetrics after having tried all other relief methods.

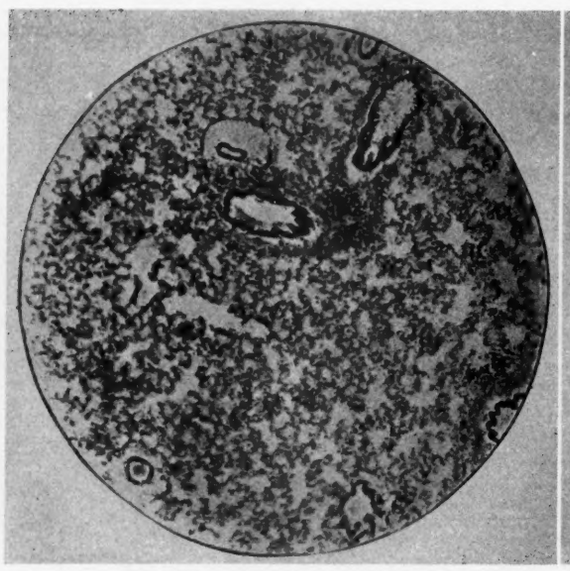


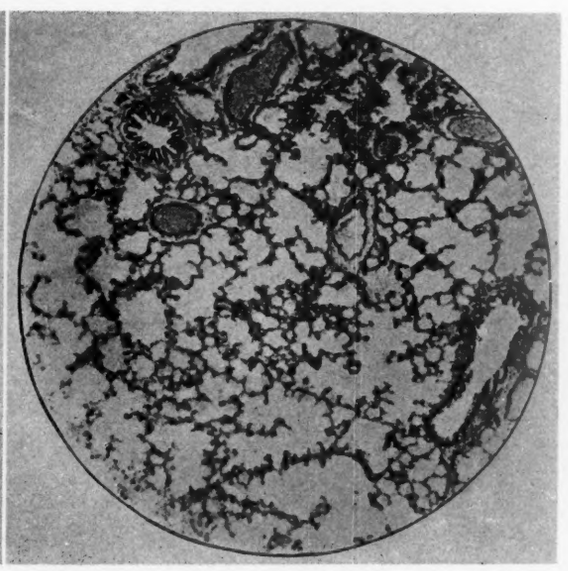


Ethylene 94 per cent, oxygen 6 per cent.

FIG. 5. No preliminary medication. Extensive alveolar and perivascular edema; air spaces filled with fluid.

FIG. 6. *Preliminary medication.* Fairly normal lung tissue.





Acetylene 94 per cent, oxygen 6 per cent.

FIG. 7. No preliminary medication. Alveolar and perivascular edema.

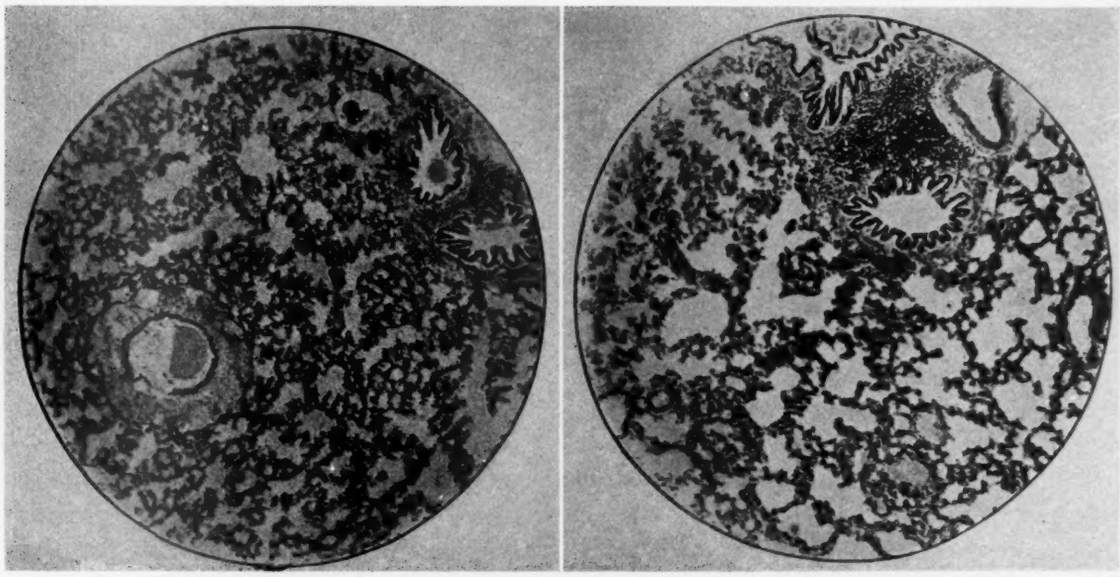
FIG. 8. *Preliminary medication.* Normal lung tissue.

spinal anesthesias without a death. Under the guidance and supervision of John Lundy, of the Mayo Clinic, the number of operations under spinal and regional anesthesia outnumber those under inhalation anesthesia. Dr. Cosgrove, of Jersey City, George Pitkin, of New Jersey, has done as much as anyone else in calling attention to the value of spinal anesthesia.

Methods of administering local, spinal and regional anesthesia are now taught in all medical colleges, but it will probably be

another decade before they are universally used. "Spinal anesthesia was used once in 1924 and more than 3,000 times in 1939." (Mayo Clinic.)

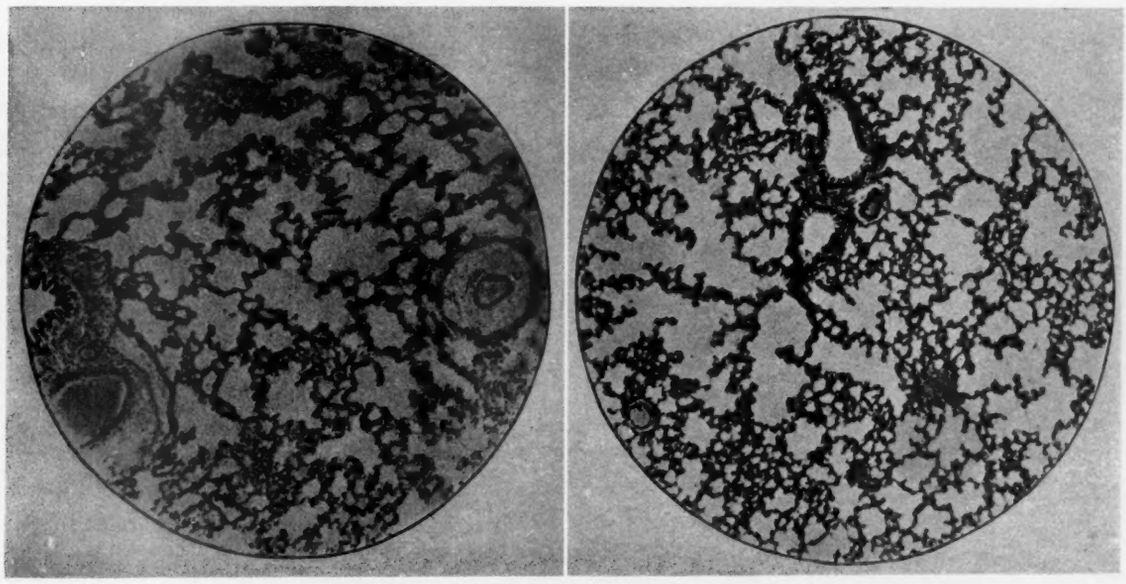
hundred and six (106) surgical operations under this gas, in April 1923, at the Presbyterian Hospital, in Chicago. It has a wider margin of safety than nitrous oxide,



Carbon dioxide 70 per cent, oxygen 30 per cent.

FIG. 9. No preliminary medication. Extensive alveolar and perivascular edema; congestion.

FIG. 10. *Preliminary medication.* Relatively normal lung tissue.



Propylene 81 per cent, oxygen 19 per cent.

FIG. 11. No preliminary medication. Perivascular edema, air spaces relatively clear.

FIG. 12. *Preliminary medication.* Normal lung tissue.

Ethylene (C_2H_4) was discovered by Ingenhauss, in 1779. Its anesthetic property was demonstrated on animals in the laboratory by Luessem, in 1885. Luckhardt and Carter made experiments on its physiologic properties, and reported one

and more oxygen can be used with it to produce the same degree of surgical anesthesia than when nitrous oxide is used. It supplied a long felt need. Ethylene has been used 58,690 times up to December 31, 1939, at the Mayo Clinic.

The objections to it, are its odor and its explosive nature. It should, therefore, be used with nitrous oxide. That is, the introduction should be with nitrous oxide and the maintenance with ethylene and oxygen. The terminal anesthetic should again be nitrous oxide and oxygen to eliminate whatever taste and odor may remain in the upper air passages of the patient.

Professor Chauncey D. Leake concludes his paper, "The Historical Development of Surgical Anesthesia," with this statement: "One of the most significant points emphasized in recent works, is the importance of *Oxygen* in anesthetic conditions. An anesthetic agent is being sought, which is to be administered with so much Oxygen, that all deleterious effects incident to Oxygen want, can be reduced to the minimum."

It would seem that *cyclopropane* is the answer to Professor Leake's wish. It was first prepared by August von Freund, in 1882, but no notice was taken of his discovery until nearly fifty years later (1929), when Lucas and Henderson published their laboratory experiments on animals. They found that anesthesia could be maintained by using 10 per cent to 12 per cent cyclopropane, with 88 per cent to 90 per cent oxygen, with but little change in blood pressure, metabolism or blood sugar and with no damage to the liver. There was a wide margin of safety between the surgical and the lethal dose. Consciousness was regained in from one to three minutes. Respiration always failed before circulation, therefore, immediate measures should always be successful.

Four years after these experimental findings, the first clinical administration was given by Neff, Rovenstine and Waters (1930), of the University of Wisconsin. Under the direction of Ralph W. Waters, professor of anesthesia at the University of Wisconsin, the technic was successfully developed, and in 1937, they reported over two thousand (2,000) administrations. The indications and contraindications for cyclopropane are practically the same as for nitrous oxide or ethylene. On account of its expense, Waters evolved the carbon dioxide absorption technic. This consists of passing the respirations through a mixture of calcium and sodium hydrate, so that the carbon dioxide is absorbed, and the respirations are kept within physiologic limits. In this way, a minimum amount of cyclopropane is used.

It is the most inflammable and explosive of all gases used in anesthesia. In spite of its many advantages and its careful introductions, deaths have occurred, principally from explosions, and, therefore, has been definitely excluded from some hospitals. Its very great advantage over other agents is that it gives a relaxation equal to that of spinal anesthesia. In order to do this, however, many anesthetists produce anoxia and then carry on respiration by pressure on the gas bag, thus producing artificial respiration. Other anesthetists claim that this is unnecessary. It would seem from conflicting reports, that cyclopropane is still on the waiting lists.

Cyclopropane has ushered in the golden era for the manufacturers of anesthetic apparatus. The latest gas machines have attachments for nitrous oxide, ethylene, cyclopropane, helium, carbon dioxide, ether and oxygen, so that the selection may be made as indicated by the patient's condition.

Vinethene: (vinyl ether, divinyl oxide) has a formula of:

	Per Cent
Pure divinyl ether	96.49
Absolute alcohol	3.5
Nonvolatile oxidation inhibitor	0.01

Vinyl ether was first suggested by Leake (Leake and Chen); it was synthesized by Major and Ruigh, and its pharmacology was studied by Leake and Gelfan and associates.

Vinethene is a clear, colorless liquid with a boiling point ten to thirteen points below the boiling point of ether. Its action is quicker and recovery is more rapid than with ether. It was developed as an anesthetic, at the University of Pennsylvania,

by I. S. Ravdin, professor of surgery, and his associates, and has been used over five thousand times in that institution. It is now employed for painful dressings and for operations of *less than one hour*, in obstetrics and dentistry, and especially for children.

Liver damage to one patient, in an operation lasting over two hours, caused the use of vinethene to be discontinued except for short operations; it is now used with oxygen which decreases the possibility of liver damage. The ratio of the anesthetic dose of vinethene to the lethal dose, is 1 to 2.4; with ethyl ether it is 1 to 1.5. For short operations, vinethene is safer than ethyl chloride; it is accompanied by less nausea and vomiting and is not as toxic to the liver as chloroform.

It is used routinely at the University of Pennsylvania, for short operations, such as, opening abscesses, inserting drainage tubes and applying painful dressings. *It should be seen in use, by those who wish to employ it,* under Professor Ravdin's direction.

COLONIC ANESTHESIA

This method was first mentioned nearly one hundred years ago, in 1847, by Pirigoff. His method was first to introduce liquid ether, and next he devised a method of vaporizing the ether by means of heat, and thus administer the drug. He reported eighty-one (81) cases, with two deaths, but the method fell into disuse. Cunningham, of Boston, in 1905, added to the technic by employing air to carry ether vapor into the intestine, a more sensible, safer, and satisfactory plan.

In 1910, Sutton published the results of a series of one hundred and forty cases at the Roosevelt Hospital, by using an apparatus consisting of three parts: (1) The generator in which the mixture of oxygen and ether was made, (2) an afferent tube system which carried this product into the intestine, and (3) an efferent for exhausting the contents of the bowel.

This method was successful, but the apparatus was so complicated that its use was never attempted by others. The record of cases of Cunningham and Sutton were prominent factors in the development of oil-ether colonic anesthesia.

OIL-ETHER COLONIC ANESTHESIA

In 1913, at the seventeenth International Medical Congress in London, the author read a paper on oil-ether colonic anesthesia. The experimental work on animals was completed just previous to this date.

George Barkley Wallace, professor of pharmacology of the University and Bellevue Medical College, conducted experimental laboratory work on animals. He found that the heart rate, respiration and blood pressure were evenly maintained in a dog under oil-ether rectal anesthesia, an experiment repeated many times with the same result.

The late Charles Baskerville, professor of chemistry, of the College of the City of New York, made laboratory experiments to determine: (1) A comparison of the rate of evaporation of ether from different mixtures of ether and the same oil, and, (2) a comparison of the rate of evaporation of ether from the same per cent mixtures of different oils.

The oils used were vegetable, animal and mineral. He demonstrated that regardless of the per cent mixture, the rate of evaporation remained constant. This would seem to indicate that oil-ether, administered colonically, is a safe procedure, giving an absolutely even plane of anesthesia.

In the laboratories of the Department of Health of New York City, experiments were conducted under supervision of the Director of the Bureau, William H. Park, on the bacteriacidal action of oil-ether mixture against the Bacillus coli. These tests showed that the mixture killed practically all B. coli in from five to fifteen minutes after exposure.

All of this work was completed in 1912 to 1913. Thus it will be seen that this method of anesthesia was most thoroughly tested before being tried upon human beings.

Clinical results were as satisfactory as the laboratory experiments. Reviewing thousands of cases with this method, we find that pulse, respiration and blood pressure remain more nearly normal with this method than with inhalation, spinal, regional or local anesthesia. The amount for the average adult, weighing about one hundred and fifty pounds, (ether, 5 ounces, oil, 2½ ounces) lasts two and one half to three hours. If the operation lasts longer, only *small* supplements are indicated, as the result is more analgesic than anesthetic. Trained nurses administer the oil-ether. It is only necessary for the anesthetist to note and rectify the condition of the patient before removal from bed, i.e., twenty minutes before operation.

LATHESIA

Recently, F. E. Guntrip, of Santa Clara, California, has invented a rubber mixture that mixes readily with ether, and reduces both the amount to be given and the expense of administration. These reasons make it superior to the oil-ether. Five ounces of ether in *lathesia*, is only five ounces, instead of the oil-ether seven and one half to eight ounces. It acts, clinically in every way as the oil-ether mixture and should popularize both the surgical and obstetrical procedures.

OBSTETRICAL ANALGESIA

An offshoot of oil-ether colonic anesthesia is the method developed for the relief of pain in obstetrics. The ideal sought was the relief of pain, with consciousness but little, if at all impaired, so that full cooperation is obtained at all times. The method was developed at the Lying-in Hospital of New York City, in 1923, exactly ten years after its successful development for surgical purposes. The method was developed under the direct supervision of Asa B. Davis, Chief, and his staff.

At that time, (1923) between three hundred and four hundred confinements occurred each month, in this hospital. Seven years later, in 1930, twenty thousand (20,000) cases were reported with the above method, from the Lying-in Hospital and other hospitals, with no increase in morbidity or mortality.

In the same year, (1930), modifications and improvements of the above method, were made by C. O. McCormick, of Indianapolis. His method was intended for the general practitioner as well as for the expert. The cooperation of the patient is enlisted, and the pain is the criterion as to when to give medication, instead of dilitation of the cervix and the usual multiple examinations. He invented a special apparatus for giving the oil-ether, by which the instillation is completed in thirty or forty seconds, instead of ten to fifteen minutes, the time necessary with the earlier catheter or funnel method. The retention is higher, better and more comfortable. Over one hundred thousand cases (100,000) of oil-ether obstetrical anesthesia, with and without McCormick modifications, have been reported in the United States without danger to mother or child. The method is now used routinely at the Indiana University School of Medicine, also at the Temple Hospital in Philadelphia and in many other hospitals. In his new book, Arnold states: "The unprejudiced testing and weighing of drugs and methods, so far developed, lead us to the conclusion that, all things considered, the Modified Gwathmey Course comes nearest to meeting all demands, under the widest range of circumstances, and therefore, that is what we shall continue to preach and practice until convinced that there is something better."

At the annual meeting of the American Medical Association, in 1939, W. C. C. Cole read a paper in which he states that a comparison of the weights of one thousand babies, showed that the loss of weight in the new born, was not physiologic as universally believed. The weight of the babies, whose mothers had received ether, was better than the weight of the babies of the untreated patients. This would seem to make it imperative for the obstetrician to

use ether for relieving pain in childbirth. C. A. Smith, of Boston, in a paper on the "Effect of Obstetric Anesthesia on Oxygenation of Maternal and Fetal Blood, with Particular Reference to Cyclopropane," states that, "Judged by biochemical data, Cyclopropane as an obstetrical anesthetic, appears to be, perhaps, less safe for the infant than the clinical appearance of the mother would indicate." Also: "In general, Ether anesthesia definitely increased the Oxygen capacity of maternal blood, and under this anesthesia, fetal Oxygenation appeared to be satisfactory." From all sources, then, it would seem that ether and oil per rectum, and ether and oxygen by inhalation, are ideal anesthetics in childbirth.

The endotracheal, endobronchial and nasotracheal anesthesia, and the more general use of the ordinary air-way tubes, have unquestionably made all forms of anesthesia safer.

PRELIMINARY MEDICATION

The data now given have been published in Nelson's Loose Leaf Surgery. Observations upon the value of preliminary medication in preventing morbidity and mortality, are not as generally known as they should be. It is our firm belief that all patients should be put to sleep and awakened in their own beds in a state of analgesia. Our reasons for this are based, as are all advanced surgical methods, upon laboratory research.

The second stage of anesthesia, commonly known as the stage of excitement, raises the blood pressure from 10 to 40 mm. systolic, ordinarily and occasionally up to 80 to 90 mm. just prior to administration of the anesthetic. This is true, even when patients are given the ordinary hypodermic of morphine (⅛ to ¼ gr.), which proves that this so-called preliminary does not completely remove psychic impulses. Pneumonia and other postoperative troubles, ordinarily attributed to ether, are due to the patient's not having received proper preliminary medication.

Almost forty years after the discovery of ether, Alexander Crombie, of the Calcutta Medical College, applied Claude Bernard's idea of pre-anesthetic medication of morphine, and thus in a great measure, abolished the disagreeable features of ether administration. As stated above, experience has proved that this medication is not satisfactory now.

LABORATORY EXPERIMENTS WITH PRELIMINARY MEDICATION

It has been proved experimentally, by Professor George Barclay Wallace, of the Pharmacological Department of the New York University and Bellevue Hospital Medical College, that when ether is administered intravenously, without preliminary medication, nearly twice as much anesthetic is required to produce anesthesia, as when preliminary medication is used. Again, without preliminary medication, a very small amount of ether produces respiratory paralysis, whereas, with preliminary medication, two and a half times the amount of ether is required to produce the same result. This proves that a laboratory animal is much safer with preliminary medication than without. The above experiment was verified several years later with ether, propylene, acetylene, ethylene and nitrous oxide administered by inhalation.

This research was under the supervision of the late Charles W. Hooper, assisted by the writer. It represents a year's work in which approximately five hundred (500) animals were employed to determine the value of preliminary medication, in inhalation anesthesia. Half of the animals were used as controls and the other half were given preliminary medication; all of them were placed in the same gas chamber. The animals without the preliminary medication had a stage of excitement, jumped around and struggled against the anesthetic. The animals with preliminary medication never moved, but sank quickly and quietly under the anesthetic and lived twice as long as the controls in the same gas chamber. Necropsy revealed that their lungs were relatively normal. The lungs of

the animals that had not received preliminary medication, on gross examination, showed distention, edema and congestion. Microscopic lesions were perivascular edema, diffused petechiae and alveolar spaces filled with fluid. The bronchi contained edematous fluid. Other organs appeared normal.

Surgeons and anesthetists in various parts of the country employ different methods and drugs for putting patients fast asleep in their own beds. It is almost the universal custom of those giving cyclopropane to use avertin with amylene hydrate per rectum for this purpose. When the anesthesia is properly timed they also awaken in bed. Others using ethylene or ether with oxygen have used evipal rectally, but in the last few years have used pentothal sodium (sodium ethyl barbiturate) with anhydrous sodium carbonate as a buffer given rectally as the basal anesthetic. The patient goes to sleep in three to fifteen minutes, never knows when he is taken to the operating room or when the mask is applied to the face, and usually awakens in his own bed. These methods follow and are in conformity with the laboratory experiments of Wallace and Hooper. The use of oxygen throughout all operations and immediately afterwards is rapidly increasing with all methods of analgesia and anesthesia.

PRESENT PROFESSIONAL STATUS OF ANESTHETISTS

The greatest advance in anesthesia is the changed attitude of the medical profession as a whole toward anesthesia and anesthetists. It is a far cry from the misery and mental suffering of the pioneers and discoverers of anesthesia to the statement of August 31, 1940, in the Journal of the American Medical Association giving complete recognition to the American Board of Anesthesiology, an affiliate of the American Board of Surgery, thus placing those qualified anesthetists upon the same professional status as other members of the profession. This board charges a fee of seventy-five dollars for an examination, which if passed, gives the anesthetist a standing in the medical profession, fully equal to that of other members of the profession.

The change has been very gradual, as with other specialties in medicine. Probably no one deserves greater credit than the late F. H. McMechan, editor and secretary general of the publication devoted to anesthesia, especially in America, and covering anesthetics in all parts of the world. All of us will agree with Howard W. Haggard when he states that "For this progress, we owe a great debt to one of the bravest men I have ever met, Dr. F. H. McMechan." Fortunately, for the cause of anesthesia, we have unusually competent men to fill his place: the editor of Anesthesiology, Paul M. Wood, and Charles J. Wells, secretary of the Associated Anesthetists of the United States and Canada.

The 1936 Year Book of the American College of Surgeons, states: "The science of anesthesia is rapidly developing. New types of anesthesia, new methods of administration, and complicated apparatus demand serious medical thought. It is unfortunate that a large number of hospitals fail to recognize the necessity and value of a well organized department of anesthesia. This presupposes competent medical supervision, preferably a medical anesthetist. . . . Such a requirement does not preclude the use of the nurse anesthetist, who is properly trained and qualified to give anesthesia. It is unfair to expect the nurse to be responsible for the service, but rather, she should work under proper medical supervision. As the administration of anesthesia is generally conceded to be the practice of medicine, and in as much as it involves risk to human life, it is only reasonable to expect medical supervision. This cannot be done properly by the surgeon, for he is frequently not especially trained in this work, nor should he have to carry the responsibility, when under the strain of operating."

So great has been the advance in discovery and administration that within the

last few years professors of anesthesia have been appointed in medical colleges, and skilled physicians are devoting their time exclusively to research in anesthesia in certain medical centers.

At the University of Wisconsin, in Madison, Ralph W. Waters has been appointed professor of anesthesia, with a staff for research and anesthetic work. E. A. Rovenstine, professor of anesthesia in New York University College of Medicine, has the same standing as other professors in the University. John Lundy, of the Mayo Clinic, Rochester, Minnesota, has long been an outstanding figure in anesthesia. He now has a staff and is devoting himself especially to regional and spinal anesthesia. Other colleges and universities are rapidly falling in line.

Yandell Henderson, professor of physiology, at Yale University, first called attention to the value of carbon dioxide, in 1906. He has also pointed out the mistake of assuming that nitrous oxide is the safest of all anesthetics, whereas, it has a very narrow margin of safety, and complete anesthesia can hardly be acquired without anoxemia. In many other ways, he has promoted the science of anesthesia.

The next great advancement in the suppression of pain, will be the discovery of some substance, taken as a pill or as a hypodermic, that will produce *general* analgesia and thus entirely eliminate all present forms of anesthesia, as it will be much safer, easier and pleasanter both to give and to take.

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HOSPITALS: 1890–1940

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IN a brief presentation like this the author can only sketch what seem to him to be the major developments in the field of hospitalization since the founding of the American Journal of Surgery fifty years ago. Limitations of space prevent the achievement of comprehensiveness while, on the other hand, an effort can be made to give coherence to a series of hospital developments which have contributed to the civilizing influences of our time.

The chronicler of hospital events, who is seeking at the same time to appraise each phenomenon as it presented itself, must lean heavily against the general historic background of his subject. The last fifty years have been densely crowded with historic events and changes have been taking place at a comparatively rapid pace during this period. This must be borne in mind, since hospitals are expected to respond promptly to social and economic changes, while cooperating with the public health movement in helping to prolong the lives of men and opening new continents. In times of peace, when planning is a calm discipline of the mind, and in time of war, when the response is on an emergency basis, the progressive hospital is in a constant state of adjustment. The stimulus in the former case comes from the normal progress of science in the biologic and mechanical world. In the latter case it is the compelling need for a victorious conclusion by the selection and care of qualified men and their rehabilitation for field service if they have suffered wounds in battle through the perverted application of the social and mechanical sciences.

The reader of a well established medical publication, such as the older Lancet (London, England) for the year 1890, must be impressed with the fact that human nature in hospital work has not changed, though human nurture has been teaching us how to extend the span of life by preventing and conquering disease. The same stern and compelling humanitarianism breathes in its pages and vitalizes them, as we find in the vastly detailed and sometimes burdensome hospital literature of today. Though the charitable motive dominates the picture in both cases, we of the machine age reluctantly come to the conclusion that pious words about the patient are not enough. The journal room of the hospital library in those days, if it were in existence, was not the time-consuming phenomenon of scientific hospital life that we know today; but that is because its contents showed less ramifications into the specialties and subspecialties, and because the day of fine discovery and invention had not yet fully dawned on the profession. If great deeds in the hospital are being recorded by the historian today, they were being recorded, too, in those days, with this difference: the last half century has brought the industrial revolution and the complex mechanical era to the hospital with on-rushing speed. The student of applied sociology, working in the modern hospital, is now concerned with the danger of losing sight of the individual in the surge of mass production and mass planning.

Fifty years ago medical men in hospitals were preoccupied with clinical situations which called forth the best use of the five senses, unassisted for the large part by the instruments of precision and the labor-saving devices that are in common use today. The interne who orders a complete "workup" on his patient would do well to read how self-reliant his immediate professional ancestors were in the diagnosis and

treatment of disease. The endoscopic procedures, improved illumination, magnification, transillumination, the *x*-ray, a large variety of diagnostic tests and mechanical therapeutic procedures, without which the modern physician does not move, were still unknown in 1890 and the hospital was that much simpler in structure as well as equipment. If this is to be called the scientific age, that was still the age of empiricism when the lights of modern science were beginning to illuminate the hospital world. Those were the days when men still took pride in shotgun prescription writing and placed great faith in it. The secret remedy was in far greater evidence. Serotherapy, radiotherapy, chemotherapy, physical therapy generally and the bolder and more extensive operative procedures were still unknown and the span of life was far from the three score and ten which we are approaching today. The horse-drawn ambulance clattering along the cobblestone streets on the way to a dreaded Bellevue Hospital was the forerunner of the deluxe motor ambulance and its more acceptable destination that we know today.

One author, writing on "Paroxysmal Hurry of the Heart" in the Lancet of 1890, may not have learned to construct the word tachycardia—and he preceded by twelve years the work of Einthoven with the string galvanometer—yet he wrote intelligently and even scientifically with the limited materials at his disposal about a clinical condition, largely functional, which seems to have been far less frequent in those days that it is in the fast-moving society that is under such severe nervous tension today. The cardiographic laboratory of the modern hospital is a development of the last twenty years and is an excellent example of the manner in which the hospital has been adapting itself to new ideas. It shows the interest of the governing authorities of hospitals in diagnostic apparatus which may be helpful, but which may not be absolutely indispensable.

The electrical engineer and the physicist have made numerous other great contributions during the last fifty years. Apart from the power plant, which is the heart of the hospital buildings, there is the field of physical and electrical diagnosis and therapy represented by the departments of radiography, radiotherapy, physical therapy generally, and such electrical instruments as the cautery, the cardiograph and the encephalograph, not to mention the various aids to the handicapped patient. One need only mention the difference in the illumination of the field of surgical operation between the twentieth century and the gas-light era to appreciate the contribution of electricity to the development of the modern hospital. The modern signal systems and the telephone switchboard, have speeded help and cooperation where, at the beginning of this period, messages were delayed because they had to be entrusted orally or in writing to slow methods of delivery. Safety for patients and staff in hospitals and the prevention of accidents of all kinds are contributions of the mechanical specialties which seem almost to have been unknown at the end of the nineteenth century.

Another way of illustrating the historical achievement of the modern hospital is to exhibit the medical chart of the patient in its evolutionary stages between the years 1890 and 1940. In the earlier days the "chart" of the patient was done in handwriting and recorded, for each medical episode separately, in a bound annual collective volume, each patient receiving scant notice of a few pages. Contrast the unit system of record keeping in the specially constructed and equipped record room in the modern hospital, where clinical biographies are complete in individual open folders from the time the ambulatory patient enters the out-patient department, (including records of previous hospitalization) through his stay in the wards, and ending with his ambulatory visits to the follow-up clinic. The volume of the modern chart, representation of the various specialties in its pages, graphic notes, cooperative opinions, microscopic tests and findings

and the possibilities of their use in series for the purpose of education and scientific deduction are striking, indeed, when one turns the pages of history back a brief fifty years.

Hahnemann Hospital Today, Philadelphia

In the earlier period new and epochal discoveries in the field of the infectious diseases were in the making. If the life expectancy is now more than sixty-one years, it is largely because of the conquest of the infectious diseases and the sharp reduction in infant mortality among civilized peoples. Typhoid fever was rampant in the earlier period and devastating epidemics of all kinds still prevailed. Nowadays the teacher is hard put to it to find a case for demonstration to students. The great influenza epidemic, which swept the world at the end of the Great War, came at a time when epidemics in civilized countries were becoming less frequent. It taxed hospital ingenuity to the limit. The cause

and cure of diphtheria were just beginning to dawn on the medical profession in the early 1890's. Prevention of this dreaded disease had yet to wait many years before Schick brought fulfillment. Meantime, important work had been done in the symptomatic treatment of diphtheritic complications. O'Dwyer invented the method of intubation for laryngeal diphtheria to tide patients over this hitherto fatal complication.

Those were the days of primitive isolation hospitals, some of which still survive in the form of asylums, pest houses, almshouses and poor-farms in various parts of the globe. The contrast of the hospitals of the metropolitan cities of today with their immaculate sanitary conveniences is striking, but that is because we know so much more about our bacteriologic enemies and therefore need not fear them.

In the field of anesthesia we find, as we continue reading, that the hospitals of the earlier days were preoccupied with the dangers of chloroform. This found expression in numerous articles, and letters to the editor, apart from the work of the Hyderabad Commission. Our concern with the danger of explosions in operating rooms of hospitals from the use of the newer anesthetics these days is reminiscent of the struggles of the first part of the last half century with this vexing problem: chloroform and sudden death; ether and illuminating gas; cyclopropane and ethylene and static electricity. New inventions and discoveries seem to bring new problems while solving old ones, and they compel a revaluation and readjustment of hospital facilities from day to day.

The tempo of scientific life in hospitals has increased progressively, mostly during the last half of the period under review, and we sometimes wonder whether money which is intended to accelerate research productivity and hasten the arrival of more and more preventives, comforts and cures, could not, in some part, be used to slow up the tempo and ease the nerves and the mind of the harrassed worker, in an era which is bewildering enough because of many conflicting forces. Of one thing we may be certain, and this is that money invested in hospitals fifty years ago brought larger proportionate returns than the vastly increased expenditures of today. This, however, is another way of saying that in the early stages small investments in hospital service, as in the case of primitive communities today, bring proportionately larger returns. As time goes on and the expenditure is increased, an optimum point is reached when the return begins to become relatively smaller. From the dormitory type of hospital which prevailed fifty years ago, we have evolved the luxurious institutions which serve the sick today. The single and double rooms, the small wards and the separation rooms in the hospitals of today were almost unknown at the end of the nineteenth century. The results are doubtless better today but they are beyond a doubt costly.

The reader of the Lancet for the year 1890 will also find, to stimulate his interest in the quaint approaches to the scientific medicine of those days, that the earlier generation was engrossed with the subject of hypnosis. Our own preoccupation with psychoanalysis is strangely reminiscent of those earlier days. The scientific student of psychology, perhaps many years ahead of his time, now insists on a cold and calculating approach to most, if not all, spiritual ills and some that are physical. Hypnosis found its place in hospitals for a time, but psychoanalysis is still an extramural activity and we are left wondering whether the exclusion of this combined diagnostic and therapeutic activity should not in itself be psychoanalyzed.

During the half century under review, hospitals have been profoundly influenced by the genius of medical men. This is but another way of saying that hospitals, apart from their fundamental purpose of serving the patient, have become the laboratories of the medical profession and responsive to that profession to a high degree. The specialty of administrative medicine, which

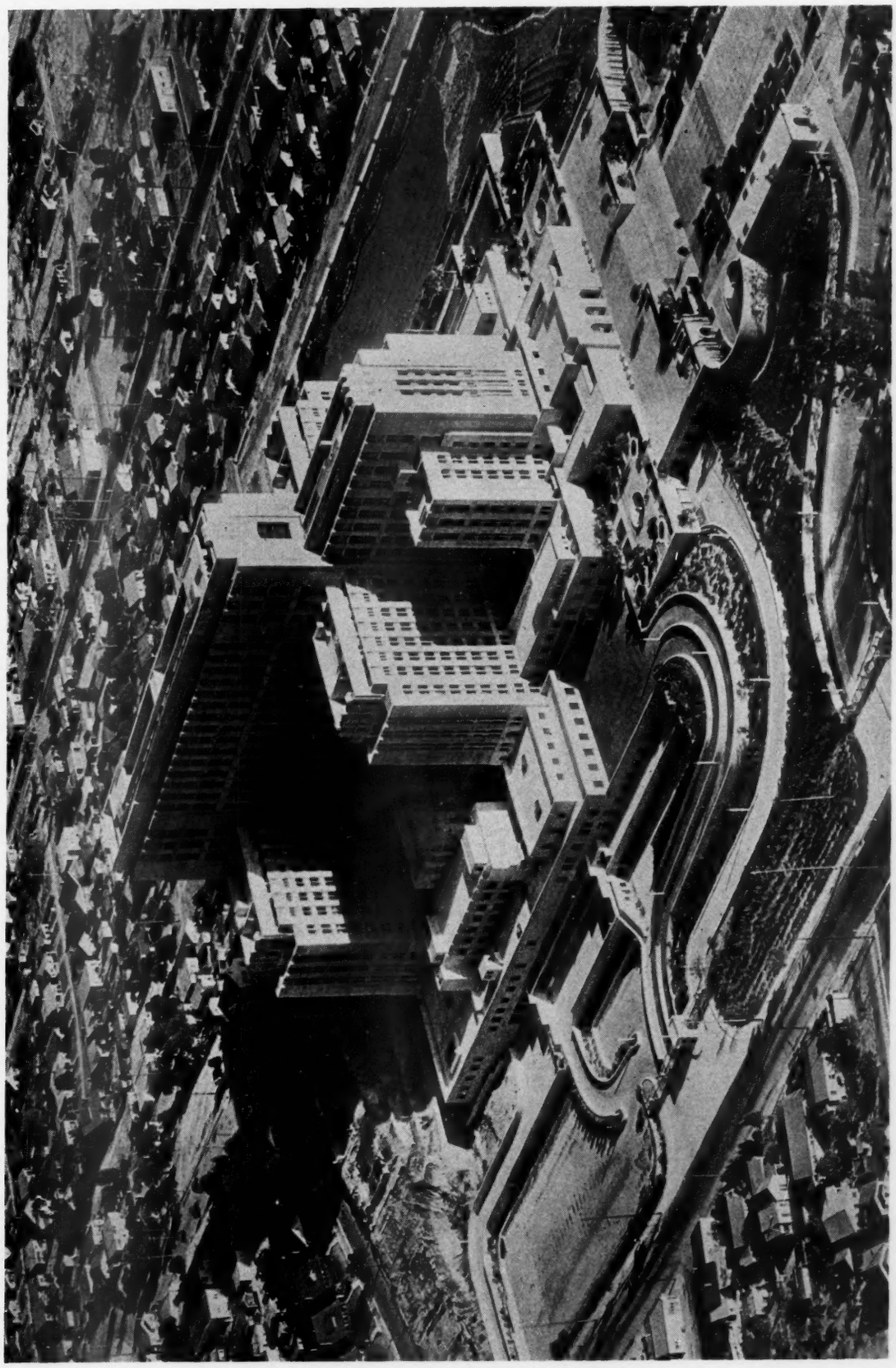
makes use of a number of special technics and which is altogether a twentieth century development, has for one of its major objectives the principle of service to the medical men of science. The clinician, freed of executive duties, has more time for his patients, while leaving administrative functions to those who are talented that way. This is in response to the spirit of the times which calls for the division of labor on a specialized basis. The days have gone when broken down clinical or clerical war horses can hope to lead a hospital group successfully. We now have such a cooperative achievement as the Hospital Standardization Conference of the American College of Surgeons in the United States. Clinician and administrator have contributed mightily, each in his way, to this cooperative relationship. Occasionally one group has successfully reached over into the field of the other, but this could only happen in the small hospital.

During the last half century medical men have so impressed their personalities on hospitals as to be inseparable from them biographically. There are numerous instances of great physicians creating great hospitals and of great hospitals creating great physicians. Dominating personalities may, indeed, be identified everywhere, in the clinic and in the office of the administration. In the management of the modern hospital, and particularly in hospital architecture, Dr. S. S. Goldwater's pioneer work is the outstanding contribution of the last three decades. In the field of group medicine, which has come to the fore as a by-product of the era of specialization and consequent cooperative effort, many notable contributions have been made in this country by clinicians. The work of the Mayos in the field of hospitalization occupies an honored chapter in the history of the hospitals of the twentieth century. In the related field of medical social service we find such an outstanding protagonist as Dr. Richard C. Cabot, working in the Massachusetts General Hospital as early as 1905. In the earlier years, a pioneer in the nursing world, Florence Nightingale, had left her impress on the hospitals which she helped so much to improve, and this was true not only in the nursing sphere, but also in the sphere of nutrition and organization.

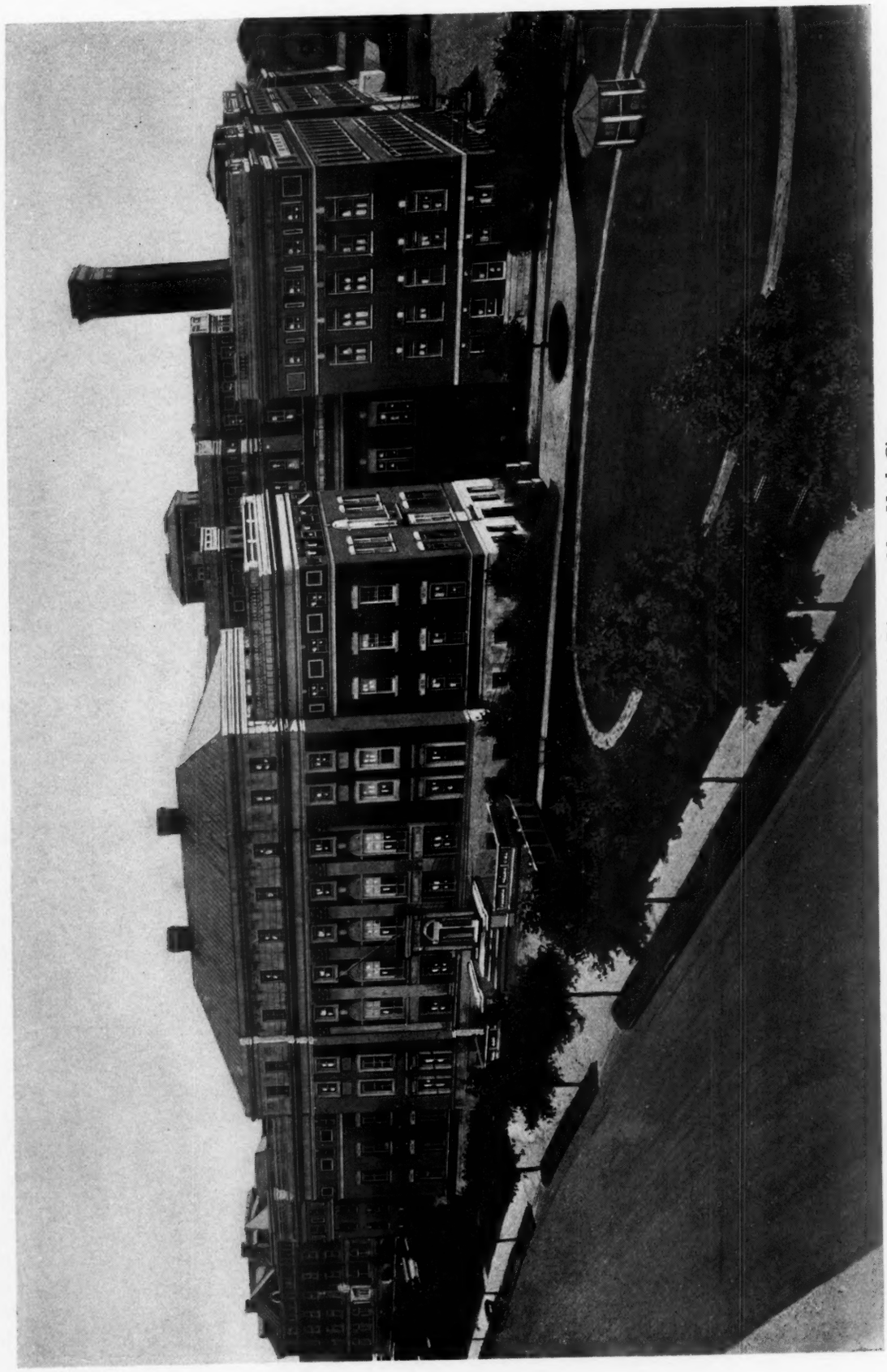
Though we still have the "cancer hospital," "home for incurables," "sanatorium for consumptives," and "lunatic asylum," as reminders of earlier designations, the tendency during this period has been to employ more euphemistic names to spare the feelings of the sick and their families. However, we are told by the public relations experts, who have recently made their appearance in the hospital, that the survival of these designations may be justified on the ground that they bring a better financial response from philanthropists who have charity in their hearts.

We have witnessed within this period the rise and start of decline of the special hospital. Integration of all specialties in groups of buildings, under the heading "general hospital," where the natural history of disease can be studied in all of its phases from infancy to old age, regardless of the mental or the physical character of the illness and regardless of the acute or chronic nature of the illness, is now the ideal. Specialization on a cooperative basis and an escape from the tendency to segregate and isolate patients away from scientific facilities at a time when they may need them most, pervades current hospital thinking on this subject.

From the smaller hospital units of 1890 we have developed an architectural plan which now includes skyscraper hospitals as well as extensive pavilion systems. The former have been made possible by the development of vertical transportation which was unknown in the beginning of the last half century. The last decade has seen the advent of the "medical center" where special hospitals are joined, often by merger with a parent general hospital, in an integrated scheme which one would be justified in calling a true medical center, if additional facilities for chronic disease were



Air View of the Los Angeles County General Hospital



Montefiore Hospital for Chronic Diseases, New York City

included. Most of the medical centers came into being at a time during the 1920's when great industrial mergers were taking place and the new hospital plan produced economic as well as social advantages. The size of the hospital unit has also increased from small beginnings in 1890 to hospitals of almost 10,000 bed capacity in 1940.

The insignificant per capita cost of maintaining a patient per day in 1890 has been multiplied several times over again with the passing of the years. Taking one large and important general hospital in New York as an example, we find that six times as many patients were cared for in the year 1939 as compared with 1890. The expense of maintaining this hospital, however, has multiplied twenty-four times within this period. This hospital treated 17,360 patients at the end of the fifty year period as compared to 2,862 patients at the beginning, and it spent $2,374,088 to take care of these patients as compared with $100,000 at the beginning of this period. These are significant figures, even if a dollar did go farther in those days. The disproportionate increase in expenditure per capita is doubtless due to the introduction and maintenance of improved facilities and the cost of experimenting with such facilities though, in the latter case, we now have the characteristic extrabudgetary fund which is earmarked for research work in hospitals and not included in the per capita cost figures. Higher costs have purchased better housing, better equipment, improved labor conditions for employees of all categories, better general and special nursing and expensive diagnostic and therapeutic facilities which have multiplied through the years. It is interesting to note, on reading the meager hospital reports of the earlier days, that deficits were played up as much then as they are now, but this is because we have not yet discovered a better substitute for appealing to the generosity of the community. Goldwater says somewhere that "a deficit is often the symbol of a noble ambition."

Hospitals may now be classed as a group among the leading major industries of this country. The total investment is in excess of three billion dollars and, at the turning point of the prosperous era in 1929, this investment was being increased at the rate of two hundred million dollars a year. The cost accountant has been unable as yet to produce an orderly picture of hospital bookkeeping and this is because of the ramifications and the rapid changes inherent in hospital service. The United States has one million beds distributed among 8,000 hospitals and half of these beds are in hospitals for mental disease. We have no accurate figures for the year 1890, but the United States Bureau of Education reported only 35,453 beds throughout the country in 1873. The figure for 1890 was doubtless much more, but it seems tiny when one contemplates the hospital field today.

The growth of specialization in hospitals is one of their major developments during the last half century. If specialization in its various forms and the division of labor are characteristic of our time, they are in full evidence in the modern hospital and it is in this phase of organization that one of the sharpest forms of contrast may be found with the hospital era which opened fifty years ago. The modern hospital draws on the industrial world, the business world, the field of hotel management, as well as mechanical engineering and the related professions for various technics and for stimulation in its progress upward.

X-ray diagnosis and later *x*-ray and radium therapy, the contributions to the modern hospital of Roentgen and later the Curies, have stimulated the creation of special laboratories in hospitals and outpatient departments. For the medical man these new developments meant greater clinical opportunities in diagnosis and therapy. It was left, characteristically, to the hospital administrator and to the physicist to work out the details of construction, protection, equipment and organization, and the result typified the cooperative spirit of the times when hospi-

tals responded promptly to new inventions and new discoveries as to needs and possible methods for dealing with them.

A few examples of special departments in hospitals might here be given. Occupational therapy came fully into its own and into the hospital as a by-product of military medicine in the zone of the interior during and after the Great War. It was a natural consequence of greater social as well as medical interest in the patient. The follow-up clinic for discharged ward patients came first, then occupational therapy and lastly rehabilitational therapy as the most recent development of record. Such organizations for the rehabilitation of the patient after discharge as the Altro Work Shops in New York came into being in 1913 for the purpose of providing sheltered workshops where the former tuberculous patient could be restored to industry by gradual steps under medical and nursing supervision. The physician, working in the hospital, now knows that the right which has been conferred upon him to prescribe involves the obligation to follow-up. The tendency to integrate service to the sick and see the responsibility through to the end has been responsible for such phenomena during the last twenty years as the union of the in- and out-patient staffs of hospitals, the follow-up clinics, the social service exchange and, as the most recent event, (accepted by the voluntary hospitals only in principle as yet) the union of the acute and the chronic hospital.

Physical therapy belongs to the latter part of this period and no hospital considers itself complete these days without the basic modalities in hydrotherapy, thermotherapy, electrotherapy and mechanotherapy. The medical profession has been slow to learn that the treatment of a patient is not always a matter of drugs or surgery and has paid dearly for its conservatism in the growth of a number of cults which magnify out of all proportion some form of cure which has restricted scientific application. This tendency left such specialties as physical therapy in a fog for many years and it is only in the last decade that the scientific physical therapist has been coming into his own. The war which has been waged on nostrums and quackery in recent decades by such representative organizations as the American Medical Association, has done much to purify the atmosphere around hospitals and to make them safe for scientific medicine. Dental service to patients in hospitals came on the horizon thirty years ago despite the expense, and now occupies an honored place among the specialties.

The sanitation of the modern hospital is a matter of major concern to the administration. The last fifty years have witnessed the epoch-making growth of bacteriology and the establishment of preventive medicine as a specialty. Studies on infection and immunity have influenced the growth of the hospital profoundly. This is true not alone of the wards, where patients may safely be kept together, but also of the sanitation of the hospital in all of its far-flung activities. Sanitary conveniences of all kinds (including air-conditioning) facilities for sterilization, the practice of asepsis generally—these are characteristic of the modern American hospital.

Asepsis in the operating room of 1940 is far different from what it was in 1890. Surgeons of those days, who are still with us, love to startle us by telling how the operator would pick up the scalpel which had fallen to the floor, wipe it on his apron and proceed with the operation. Howard Lilienthal, in one of his published reminiscences recently, wrote the following: "To see Gruening extract a cataract was something never to be forgotten. Cocaine, a gift to the world by Carl Koller, was not employed when the case was that of an obstreperous patient, choloroform being then given the preference. The Graefe knife was held in the mouth of the operator, its ivory handle projecting from the right, the keen blade from the left, barely missing the gray beard and the luxuriant moustache. The local preparations of the operative field were made: the scrubbing and irrigation of

the conjunctival sac, the insertion of the speculum. The corneal section was then skillfully executed and the knife at once conveniently replaced. The cystotome divided the capsule, usually after iridectomy, the lens was extracted and the bandage applied. Through it all, gentle quiet conversation went on defying what would ordinarily be regarded as an impediment to speech." Then the author, with a twinkle in his eye, adds this sentence: "Although there had been apparent disregard of asepsis or antisepsis, not a single case of infection was observed by me." Contrast those days with these when the science of ophthalmology has been revolutionized by the slit-lamp and corneal microscope of less than two decades ago and read what Charles B. Meding has to say after fifty years of ophthalmic surgery: "I witnessed extractions by Herman Knapp in 1888 and by Nettleship in 1889. I have never seen either surpassed in method, skill or results."

In a later paragraph, Lilienthal relates the following: "An anecdote follows, illustrating what can be done with perfect technical surgery and no attempt at asepsis: In my first year of practice there was a case of impassable stricture of the deep urethra in which I had asked Dr. Fluhrer to be present to share responsibility and to lend a hand if necessary. A filiform bougie was passed as far as it would go and then perineal section was undertaken by me. Things went too slowly and finally Fluhrer took the knife. Believe it or not, he sharpened the blade on his shoe and with a few swift strokes the urethra was entered. There was no postoperative complication. The wound, of course, was left wide open, and the perfect drainage took care of possible contamination."

Asepsis is almost odorless now, by contrast with the odor of "doctor" and "hospital" of the earlier days. The bolder surgical approaches were not yet being attempted then. The complication of shock was not clearly understood and intravenous medication was as yet unknown. Though we like to feel, in our search for the ideal, that the entire purpose of medicine is to obviate the need for surgery, we have discovered and invented ways and means of relieving suffering by operative procedures which were not dreamt of fifty years ago. The hospital has contributed, in large measure, to the development of the science of surgery, for it is true that without the operating room facilities of the modern hospital surgery would not have made the great strides which are its glory now. In the earlier days McBurney in this country and Treves in England were taking public pride in the newly developed operation of appendectomy. Today the hospital operating room witnesses the most delicate neurosurgery, the most extensive thoracic surgery and the finest kind of abdominal surgery. The universal performance of certain types of surgery in hospitals, of which the tonsil and adenoid operation is a good example, reached its height and receded in the period under review. The enthusiast in the hospital is happily subject to scientific influences and clinical conferences which are now mandatory.

The single room laboratory of 1890 has grown into the elaborate separate building of later years and, while the earlier unit was limited to clinical microscopy and elementary pathology, we now have the great subdivisions of gross and microscopic pathology, physiology, pharmacology, biochemistry, bacteriology, serology and hematology, each under the jurisdiction of a specialist in the larger hospitals. The necropsy averages in the hospitals of America today are far in excess of what they were fifty years ago, soon after Rokitansky went to his reward and while Virchow was completing his monumental contribution to cellular pathology.

One can only guess the emotions of the medical giants of the end of the nineteenth century if they could return and survey the hospital facilities of today. Reviewing the pages of the Lancet once more, we pick at random such dominating clinical figures in hospitals as Brown-Séquard, Charcot, Gowers, Hughlings Jackson and His in the

field of neurology; Koch, Pasteur and Ehrlich in the field of the infections; Billroth, Lister, Von Bergmann and Mikulicz in surgery, our own Abraham Jacobi in the field of pediatrics and the philosophy of medicine, Paget and Nothnagel ("Nur ein guter mensch kann ein guter arzt sein") in medicine and Helmholtz in physics. There were many others, too numerous to mention, each of whom left his indelible impress on the developing hospital of his time. Oliver Wendell Holmes, 81 years old when this Journal was born, would have been an interesting commentator on some of the hospital practices of today.

With the passage of the last fifty years life expectancy is twenty years closer to the Biblical span than it was in 1890. This, too, has brought its hospital problems for with the conquest of the infectious diseases which this period has seen we are now confronted with more and more of the degenerative and of the malignant diseases which prevail in middle life and in old age. This has brought the problem of chronic disease to the fore and hospital authorities are now giving this subject some of their best thought. One need not lay claim to the gift of prophecy in predicting that the next major development in hospitals will take place in this field. There is still but one independent hospital for chronic disease of high standard in the voluntary classification and that is the Montefiore Hospital for Chronic Diseases in New York. Most hospital workers agree that provisions will have to be made shortly for this type of patient who requires the best scientific service that may be available.

In the year 1890, and for some time thereafter, the tendency of deliberately keeping the mortality rate low by avoiding too many surgical risks and the exclusion of the hopeless type of case was still noticeable in hospitals. We have more effective ways of judging hospital efficiency now. There is far less tendency these days to refuse admission to a patient on the ground of either duration of illness, age, prognosis, curability or economic condition. The hospital, as a temporary home for the sick, is a far more popular institution than it was at the end of the nineteenth century and all classes of society now enjoy its benefits.

It was not till the turn of the century that the better hospitals in this country began to recognize clinical differentiation and established independent services such as the neurologic division. At about the same time private pavilions for the wealthier classes began to appear in voluntary hospitals. Many of them helped to maintain the wards of these hospitals. *X*-ray departments made their appearance at about the same time. Dietetics, now called the science of nutrition, appeared five years later as a thoughtful commentary, in a sense, on the surviving hospital pharmacy of the earlier days. The newly discovered relation of food to disease found expression in the modern dietotherapy departments of hospitals. Shortly thereafter medical social service, with its tremendous special contribution to the cure of the sick, made its appearance. It was not till the 1920's that a few of the better hospitals in the metropolitan area began to establish pay clinics, diagnostic clinics and consultation services where the benefits of group medicine could be provided at cost.

Proprietary hospitals have been multiplying of late and these are maintained for profit, while serving the medical profession as "open hospitals." The maternity hospital, either as an independent institution or as part of the general hospital, put in an appearance and vastly more babies are now being born in hospitals than ever before. The midwife of the earlier days has almost disappeared from larger communities. Coincident with the growth of the maternity hospital came the concern of the medical profession over the rise in maternal mortality.

A very recent development in the field of medical sociology and medical economics and one which bids fair to strengthen the financial support of voluntary hospitals, is

the group-insurance movement which is so well represented by the Associated Hospital Service of New York. The voluntary hospitals are an integral part of this movement and contribute to its development in various ways. More than five million subscribers in this country are now eligible for private hospital care, many of whom would have been compelled to accept ward service during illness.

In the field of American hospital literature, we find the establishment of The Modern Hospital (Chicago) twenty-seven years ago, the first important publication in the field of hospital journalism. This subject had previously received only brief notices in the medical journals. The most recent contribution in this field is the magazine known as Hospitals, which first appeared five years ago as the official organ of the American Hospital Association, succeeding the earlier Bulletin. Hospital Management and Hospital Progress also contribute their share to this new field of activity. Books on hospital administration have begun to appear during the last decade and there are signs of greater interest in this activity in the near future. The three-volume Hospital Survey of the City of New York, the last and most important of the group hospital surveys, published in 1938 under the auspices of the United Hospital Fund of New York, is an excellent example of awakening communal interest in an orderly hospital program.

In the field of organization we find the advent of the American Hospital Association in 1899 and its ultimate expansion to include more than 2,500 member hospitals, besides an equal number of personal members. The International Hospital Association got off to an auspicious start in America in 1929, but became one of the casualties of the second World War ten years later. At the moment of writing the Pan-American Hospital Association is in the process of organization. The American College of Hospital Administrators made its appearance in 1934 and is a rapidly growing influence in the development of the American hospital.

Among the standardizing bodies which have promoted the scientific and ethical interests of the hospital one finds the American Hospital Association, the American College of Hospital Administrators, the American College of Surgeons, and the American Medical Association, each of which has a vital interest in the development of the program of hospitalization in this country. Apart from these, numerous state and regional hospital organizations have come into being. Organized medical bodies like the county medical societies and the academies of medicine maintain committees on hospital service and cooperate actively with hospitals. Organization is a characteristic of our time and many a physician has begun to complain about burdensome committee work in a perplexing era of scientific and economic competition.

We have also to record the growth of hospital councils in recent years. These are, for the most part, coordinating bodies which seek to distribute hospital service on a high plane in situations in which it is most needed. Among helpful cooperating bodies are such related organizations as the National Tuberculosis Association, the American Society for the Control of Cancer, the Welfare Council of New York, and such joint activities as the New York Committee on the Study of Hospital Internships and Residencies which have a voice in the development of the hospital educational program.

During the period under review we have seen the rise of the philanthropic contribution, best exemplified in the voluntary hospital—the pacemaker of all hospitals and therefore the aristocrat of the group—which has achieved a great measure of success through voluntary effort and initiative on the one hand, and the absence of political influence and bureaucracy on the other. However, the great depression which descended on us in 1929 has had a profound

influence on the ability of philanthropy to continue its contribution and it may very well be that the financing of hospitals in the years to come will have to be radically altered. The development of cooperative effort in the collection of funds along the lines of the United Hospital Fund of New York, which was organized in 1879, has received impetus particularly in the last two decades of this period. Generally speaking, government subsidies to voluntary hospitals have been on the increase.

It must be recorded that labor relations in hospitals have improved to a marked degree in recent years coincident with the tendencies of the social security movement in this country. Hospital payrolls now account for 60 per cent of the expenditures of the hospital. The radio, the talking picture and the aeroplane have had their influence on hospital service. The better hospitals now have radio outlets at the bedside. They also have talking pictures, not only to entertain patients in hospitals but also to teach students medical and surgical diagnosis and therapy. The aeroplane ambulance has shortened distances between the sick in outlying communities and the medical centers. Patients no longer fear either voluntary or public hospitals as they did fifty years ago and they do, indeed, seek hospitalization far more frequently today then they did in the earlier years. The establishment of a separate department of hospitals in the administration of the City of New York seven years ago marked a turning point in the confidence of the public in municipal hospitals.

There were practically no major educational requirements, as prerequisites for the study of medicine for the class of 1890, and graduates were not yet obliged to submit to examination for license to practice medicine in those days. Tuition fees were low. The course of study had just been increased from two to three years. This should be compared with the high standards of admission in 1940 and the length of time and considerable expense which must now be faced by a good student wishing to perfect himself and measure up to the requirements of the specialty boards of later years. The requirement of hospital internship, which now prevails in many states, came as a much later development. There are several important medical schools today which do not grant doctors' degrees in medicine before the completion of a one-year hospital internship.

The contribution of the hospital to medical education has been extended in scope, particularly during the last decade. Flexner's report, almost thirty years ago, still finds an echo in the modern hospital. The various licensing boards in the specialties depend on the cooperation of hospitals for the training of general and special medical men. In recent decades we have witnessed the growth of fellowship subsidies for research work in hospitals and there has been a general tendency to increase the number of full-time and part-time medical service in the clinics, as well as in the laboratories of the hospital.

A number of epochal changes have revolutionized society since this Journal was born and each of them has had its influence on the development of the modern hospital. The decade before the turn of the century was by far the most calm of this entire period, ushering in the dawn of a new era for the hospital. Medical men, singly, predominated and the hospital formed the background. This was followed by the prewar period when a number of our best hospitals some called, for obvious reasons, university hospitals, came into being. Hospitals became better known and shared honors with medical groups. The Great War precipitated a number of new and varied hospital movements, some under military influence. Then came the post-war period of readjustment and the development of the veterans' hospitals in this country. That came to be known, after the year 1929, as the prosperous era, and it was in those years that hospital architecture and planning reached its highest achievement in America. The great depression which followed brought retrenchment and

economies in expenditure. Schools of nursing which had flourished and drew heavily on hospitals for their sustenance began to close because of an overproduction of nurses, and physicians, who had given generously of their time for the care of the sick poor in hospitals and dispensaries, finding their very existence menaced, began to clamor for subsidies to neutralize their losses in private practice. Now, we are in the midst of a second destructive conflagration in the world and there is no prophet among us who can confidently look into the future.

Correction: Dr. Louis J. Hirschman wishes to correct a statement made in his article entitled "Anal Fissure," on page 639 published in this Journal in December. In speaking of watery solutions of local anesthetics Dr. Hirschman mentioned a 2 per cent nupercaine solution. This should have read 1/10 of 1 per cent.

SURGERY AND THE AMERICAN MEDICAL ASSOCIATION

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CHICAGO, ILLINOIS

FROM the very foundation of the American Medical Association in 1847 surgeons have played a conspicuous part in its leadership.

THE PRESIDENTS

In the ninety-three years during which the organization has functioned (during two of which there were no sessions and no elections to the presidency), fifty-one surgeons have held the office of president. Thus, out of a total of ninety-one presidents, fifty-one have been surgeons—certainly a large percentage in view of the fact that the surgeons have seldom constituted as much as 10 per cent of the membership.

The names of the surgeons who served as president follow, together with the year and the place of meeting at which they served:

Year and Place of Meeting	President
1848 Baltimore	Alexander H. Stevens, New York
1849 Boston	John C. Warren, Massachusetts
1850 Cincinnati	Reuben D. Mussey, Ohio
1851 Charleston, South Carolina	James Moultrie, South Carolina
1853 New York	Jonathan Knight, Connecticut
1854 St. Louis	Charles A. Pope, Missouri
1856 Detroit, Michigan	Zina Pitcher, Michigan
1857 Nashville, Tennessee	Paul F. Eve, Tennessee
1868 Washington	Samuel D. Gross, Pennsylvania
1872 Philadelphia	D. W. Yandell, Kentucky
1876 Philadelphia	J. Marion Sims, New York
1878 Buffalo	T. G. Richardson, Louisiana
1880 New York	Lewis A. Sayre, New York
1881 Richmond, Virginia	John T. Hodgen, Missouri
1882 St. Paul	J. J. Woodward, U. S. Army
1883 Cleveland	John L. Atlee, Pennsylvania
1885 New Orleans	H. F. Campbell, Georgia
1886 St. Louis	William Brodie, Michigan
1887 Chicago	E. H. Gregory, Missouri
1888 Cincinnati	A. Y. P. Garnet, District of Columbia
1889 Newport, Rhode Island	W. W. Dawson, Ohio
1890 Nashville, Tennessee	E. M. Moore, New York
1891 Washington	W. T. Briggs, Tennessee
1892 Detroit	H. O. Marcy, Massachusetts
1893 Milwaukee	Hunter McGuire, Virginia
1895 Baltimore	Donald MacLean, Michigan
1898 Denver	Geo. M. Sternberg, U. S. Army
1899 Columbus, Ohio	J. M. Mathews, Kentucky
1900 Atlantic City, New Jersey	W. W. Keen, Pennsylvania
1901 St. Paul	C. A. L. Reed, Ohio
1902 Saratoga Springs, New York	John A. Wyeth, New York
1905 Portland, Oregon	L. S. McMurtry, Kentucky
1907 Atlantic City, New Jersey	Jos. D. Bryant, New York
1908 Chicago	H. L. Burrell, Massachusetts
1911 Los Angeles	John B. Murphy, Illinois
1915 San Francisco	William L. Rodman, Pennsylvania
	Albert Vander Veer, Albany, New York
1916 Detroit	Rupert Blue, United States Public Health Service
1917 New York	Charles H. Mayo, Minnesota
1918 Chicago	Arthur D. Bevan, Illinois
1920 New Orleans	W. C. Braisted, U. S. Navy

Year and Place of Meeting	President
1925 Atlantic City	William D. Haggard, Tennessee
1927 Washington, District of Columbia	Jabez N. Jackson, Missouri
1929 Portland, Oregon	Malcolm L. Harris, Illinois
1931 Philadelphia	E. Starr Judd, Minnesota
1932 New Orleans	Edward H. Cary, Texas
1933 Milwaukee	Dean Lewis, Baltimore
1936 Kansas City, Missouri	James Tate Mason, Washington
1937 Atlantic City, New Jersey	C. G. Heyd, New York
1938 San Francisco	Irvin Abell, Kentucky
1941 Cleveland	F. H. Lahey, Massachusetts

Of course some of those listed as surgeons in the earlier years were men who practiced also to a considerable extent in the general field of medicine, but all of them certainly gave of the majority of their time for surgical work.

The presidential addresses of these physicians before the American Medical Association did much to stimulate and formulate the advancement of surgery in the United States. They were concerned not only with problems of surgical technic but also largely with the special ethical problems that concern the surgeon, as well as with the improvement of the teaching of surgery and of the integration of surgery into all of medical practice.

THE SECTION ON SURGERY, GENERAL AND ABDOMINAL

The article by Dr. Arthur W. Allen, elsewhere in this issue, indicates the contribution that has been made by the Section on Surgery, General and Abdominal, of the American Medical Association, to the advancement of the science of surgery in this country. From the very first that Section has been a forum to which physicians who were especially interested in surgery could come for the exchange of views. Here also there was opportunity not only for the surgeon who qualified by membership in leading surgical organizations but also for the general practitioner who devoted himself largely to surgical problems and who found it necessary, in a life of service in a less well-settled area, to participate in other aspects of medical practice.

THE JUDICIAL COUNCIL

One of the most significant functions of the American Medical Association has been its contribution to the standardization and advancement of the ethical attitudes concerned in surgery. There has been hardly a session of the House of Delegates, since it became the official body of the American Medical Association charged with the establishment of policy, in which considerations of such matters have not occupied much of the attention. The Principles of Ethics of the American Medical Association are, of course, specific in their condemnation of solicitation of patients or procurement of patients by indirect advertising. These Principles, furthermore, establish carefully the proper relationship that must exist between the physician in charge of the patient and his consultant. They define contract practice, and they state clearly: "When a patient is referred by one physician to another for consultation or for treatment, whether the physician in charge accompanies the patient or not, it is unethical to give or to receive a commission by whatever term it may be called or under any guise or pretext whatsoever." Again and again in its considerations the Judicial Council has reemphasized this high principle. Indeed in 1924 it made a very special pronouncement on the subject, in which it said:

"DIVISION OF FEES"

"Whispered reports and even open statements to the effect that the practice of fee splitting prevails in many places have been heard with increasing frequency during the last year or two. Since the last meeting of this House of Delegates at least two signed communications regarding this subject have come to the Council which deserve

special mention. Each of these makes the point that it is or may be possible that county societies having jurisdiction cannot take action to correct the evil of fee splitting because enough of the members of these societies indulge in the practice to prevent such action. One of the communications referred to came from a Western city, the other from a Northern state. It is contended that, because of the impossibility of securing corrective action by county societies, the American Medical Association should act to investigate existing conditions, expose whatever is found that is reprehensible, and create a situation whereby members of county societies who engage in the practice of dividing fees would be forced out of membership.

"The Judicial Council does not know that the practice of fee splitting prevails generally to anything like the extent indicated by the letters and rumors that have come to the attention of the Council and which purport to describe the situation in the communities from which these came. Moreover, the Council earnestly hopes that the conditions described as existing in those communities have been exaggerated and overstated. As has been done in former reports, however, the Council wishes to record its condemnation of this pernicious practice wherever it may be found, and to urge component societies and constituent associations to purge their membership of any who wilfully refuse to desist from such practice, the continuance of which can only bring dishonor and reproach on the medical profession. So far as its power extends and its jurisdiction reaches, the Judicial Council will undertake to deal with any specific cases which may be presented to it and to render judgment in any cases in which necessary evidence for conviction is put before the Council. It is not felt, however, that the American Medical Association, through any of its established agencies, should go into territory within the primary jurisdiction of any of its units of organization for the purpose of discovering facts that could be obtained only on the evidence of members of component societies, which are specifically charged with the duty of maintaining the honor of the profession and which have duly constituted machinery for bringing transgressors to account.

"The Council suggests that, when a county society is found to enroll so many fee splitting, or otherwise unethical, members as to render it impossible for that society to enforce the ethical standards of the medical profession, in accordance with the laws of our medical organizations it then becomes the duty of the state councilor, whose district embraces such society, to bring the situation before his state board of councilors and have the charter of such recalcitrant society annulled and in its place to have issued a new county society charter, in the name of well known ethical physicians of such county, in order that a society with ethical standards may be organized and maintained."

Especially important also has been the work of the various sections of the American Medical Association and of the House of Delegates in the cooperation which they have given to the setting up of the boards for the examination and certification of young men who have qualified as specialists. In this work the various agencies of the Association especially concerned with surgery have had a very large part.

THE SPECIAL COUNCILS

Incidentally, every one of the councils of the American Medical Association, including particularly the Council of Medical Education and Hospitals, the Council on Pharmacy and Chemistry, and the Council on Physical Therapy, has on occasion given consideration to problems in the field of surgery. The Council on Pharmacy and Chemistry has made special reports on antiseptics and on sutures. Indeed, it led in the establishment of a procedure whereby government agencies responsible for maintaining standards of foods and drugs would also be concerned with standards for sutures.

The Council on Medical Education and Hospitals has made independent investigations of hospitals and more recently has entered a cooperative effort with the Division of Hospitals of the American College of Surgeons in the standardization of hospitals.

The Council on Physical Therapy has been especially concerned with the development of various devices used in surgery, particularly, of course, the *x*-ray and instruments for electric coagulation and dissection.

More recently the Council on Industrial Health has been making independent investigations on health in industry and has given special attention to the problem of first aid and the care of the injured in accidents.

Thus the American Medical Association has been through the years an organization in which surgery, both in its social relationships and in its practice, has been integrated with the entire medical cosmos.

ARCHIVES OF SURGERY

In 1920, the Board of Trustees of the American Medical Association took action establishing a periodical, the *Archives of Surgery*, in order to complete the list of periodicals in special fields of medicine, which already included publications in internal medicine, diseases of children, neurology and psychiatry and some other fields. It was determined at that time that the *Archives of Surgery* was not to be particularly in competition with journals of surgery already in existence, and the task of the editor then selected to head this publication, Dr. Dean Lewis, was to develop an organ which would be concerned primarily with the field of surgical research, investigation and education. It was proposed primarily to enlarge the surgical horizon and to assist in establishing surgery on a sounder basis. Since the publication of the first issue in July 1920, which began with a cooperative article on splenectomy prepared by Dr. Harvey Cushing and Dr. W. G. MacCallum, the *Archives of Surgery* has held a high place in the field of medical letters. Its original contributions have been so significant that it has been on many occasions the most frequently referred to in periodical literature of all publications in the field of surgery.

In 1920, when the *Archives of Surgery* was established by the American Medical Association, there were but two important periodicals in the surgical field. Then the space available was hardly sufficient for the publication of all contributions of value. The highly technical character of much of the material which appeared in the *Archives of Surgery* tended to divert attention to some extent from the *Archives* to other surgical publications which more particularly stressed contributions in the field of clinical surgery.

Following the serious illness of Dr. Dean Lewis, the Board of Trustees determined in 1939 to expand the editorial board of the *Archives of Surgery* and to modify the nature of its contents to make it fulfill more completely its original purpose. Dr. Waltman Walters of Rochester, Minnesota, has therefore served since July 1939 as editor-in-chief of the *Archives of Surgery*. Publication is now in its fortieth volume and contributes each year more than 2,000 pages to the available surgical literature of this country.

THE INFLUENCE OF THE AMERICAN MEDICAL ASSOCIATION ON SURGERY

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DR. N. S. DAVIS, of Chicago, was greatly interested in the organization of the American Medical Association. In 1855, he published the early history of the Association, describing its formation following a preliminary first meeting held in New York in 1846. The next year at Philadelphia, the organization was completed and the first annual meeting of the Association was held in Baltimore in 1848. Although at this and several subsequent meetings improvement in medical education and reports on epidemic diseases were the chief topics of interest, we find that many of these early dissertations dealt with clinical subjects.

Beginning in 1851, scientific contributions were submitted to special committees for appraisal and each year a prize was given for the best essay. Apparently, the first paper on a surgical subject to rate this distinction was by Dr. Washington L. Atlee of Philadelphia on "The Surgical Treatment of Certain Fibrous Tumors of the Uterus, Heretofore, Considered Beyond the Resources of the Art." This was at the sixth annual meeting held at New York in 1853. One might consider this to be the beginning of a steady, continuous and ever-increasing influence of the American Medical Association on the development of surgery in this country. In 1859, at the twelfth annual meeting, a resolution was adopted to divide the scientific sessions into four sections. These were (1) anatomy and physiology, (2) chemistry and materia medica, (3) practical medicine and obstetrics, and (4) surgery. Subsequently, there were numerous changes in the sections from time to time according to the interests of the members and scientific advances.

Soon the section on surgery and anatomy was established and continued as such until 1908; after which time it became Surgery, General and Abdominal. From this section various surgical specialties were set apart from time to time as separate sections; the first of these comprised Ophthalmology, Otology and Laryngology in 1878. There was more latitude in surgery in those early days than exists today but it was obvious then that specialties were well on their way. However, interests are still sufficiently broad to combine occasionally sectional meetings for a portion of the program with great success. Often members are faced with conflicting desires to hear papers that are being presented in different sections at the same time. On the whole, these divisions of the huge field of medicine have worked out satisfactorily.

This Association gave the first opportunity for the discussion of scientific subjects before groups of physicians from all parts of the country. Long before surgical societies of national scope were organized, the surgical section of the American Medical Association demonstrated the importance of such meetings. Early reports of new surgical procedures, changes in surgical technic and anesthesia, and statistical data on end results have accounted for the steady increase in attendance. Members not able to attend these meetings anxiously await the published reports in the Journals of the Association. This effort on the part of American physicians to keep abreast of the times, for the sake of their patients, is a characteristic of which we are justly proud. Not only the teachers of surgery in medical schools and clinics may participate, but frequently papers of great importance have come from surgeons in isolated communi-

ties. There is also an opportunity for the younger man to make a contribution to science before he is eligible for membership in many surgical societies.

THE PROBLEM OF APPENDICITIS

As one reviews the transactions of the Section on Surgery, many impressive periods in the development of this art are brought to light. Before this section, the appendicitis problem has held the limelight in the various eras of our knowledge of the subject. The presentation of Fitz, who first described the disease more than fifty years ago, was quickly followed by much discussion regarding the proper treatment. That it soon became recognized as a surgical entity is not surprising, since it was easily demonstrated in those early days that removal of the offending appendage was attended by a high percentage of satisfactory results. Dr. John B. Deaver presented many papers on this subject and he with many others of his time was instrumental in bringing about a standardization of the management of the varying manifestations of this disease. A great number of men reported their experiences in this field, which developed so rapidly, in such a manner as to bring about a certain amount of clarity concerning the situation. As surgical and diagnostic methods improved and the careful analysis of large groups of patients became available, there has been a tendency to keep the subject of appendicitis and its treatment in the foreground. The reason for this constant vigil over such a widespread disorder is the fact that every year there are more deaths from this cause in the United States of America than from any other except cancer. When one considers that most of the victims of appendicitis are in the younger generation, it seems all the more reasonable to devote as much time as can effectively be spent in discussing the reasons for our failures in this group of patients. Doubtless, until the mortality rate has reached a much lower level than at present, there will continue to be one or more presentations on the subject at each annual scientific assembly.

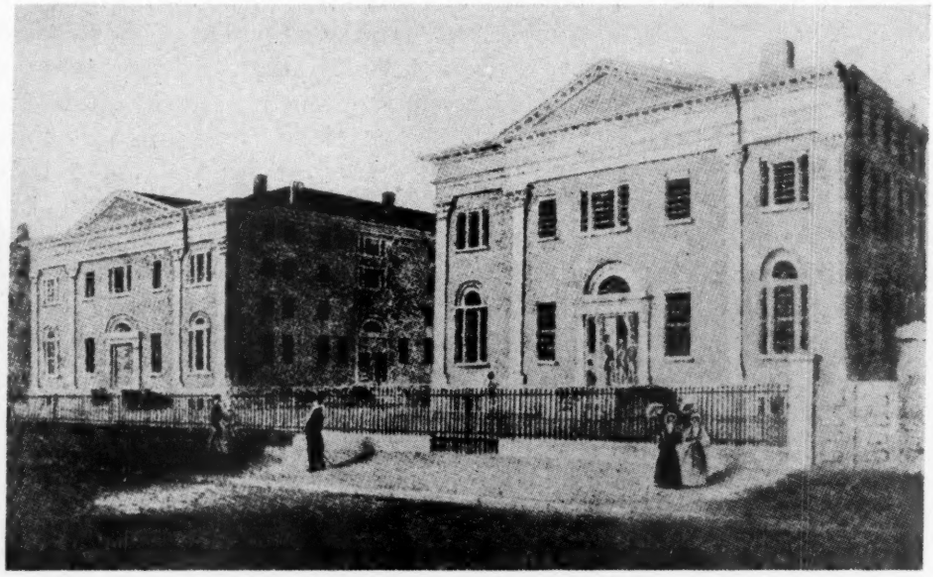
THE MANAGEMENT OF GOITER

The development of the surgical management of goiter is an interesting section of the American Medical Association meetings. Medicine and surgery collaborated on the standardization of the treatment of thyroid diseases. Marine made his contribution to the subject of endemic goiter and by succeeding legislation has practically eliminated this type of disease in the Great Lake districts. To the private clinics must be given the credit of treating large groups of patients in a certain manner and reporting end results. This type of report was extremely valuable in standardizing the treatment of many disorders and is spectacularly true in the treatment of goiter. Dr. W. S. Halstead was a pioneer in this field of surgery in this country and his basic principles, regarding the importance of the parathyroid bodies, revolutionized the whole problem of thyroid enucleation. At a symposium on the subject more than twenty-five years ago, the groundwork was laid for the study of goiter by a special commission. Gradually, a satisfactory understanding of thyroid diseases has come about.

GASTROINTESTINAL SURGERY

Gastrointestinal surgery went through a most interesting and varied developmental period. At a time when the peptic ulcer victim felt doomed to a life of dyspepsia, gastroenterostomy became the great panacea for all stomach trouble. John B. Murphy invented his famous button to facilitate a union between one segment of the gastrointestinal tract and another. In emergency cases, this proved a great boon to the surgeon in the early days when sutures and suture material were not well understood. The immediate relief following gastroenterostomy in peptic ulcer created such a widespread adaptation of the operation that it has required more than twenty-five years to evaluate it properly. The

gastroenterologist came into the picture and, by a careful management of the patient from hygienic, dietary and medical measures, has taken over this group of patients. Surgery is now being resorted to in the complications of this disorder and in a small percentage of cases particularly resistant to palliative management. Experience in operative procedures on the stomach accumulated and the type of operation has gradually been adjusted to the character of the lesion.



The University of Pennsylvania
The Medical Building (right) and College Hall (left) at Ninth and Chestnut Streets, which replaced the Presidential Mansion.

ANESTHESIA

Anesthesia, being so vital to the development of surgery, was always a subject of interest in these sectional meetings. Contributions of great importance are reported in the transactions. The proper evaluation of anesthetic gases has been brought before the surgical profession as rapidly as experience in this field could be obtained. The use of local anesthesia by infiltration, field block and the spinal canal has become widespread. The safety of these procedures was demonstrated by animal experimentation and the danger zones and limitations gradually worked out. The surgeon is no longer hampered by the fear of inadequate anesthesia and can proceed in a careful, bloodless manner that allows him to carry out extensive operations with little or no shock to his patient. Only recently has a separate section on anesthesiology been set apart from surgery. The further researches of this important section will be of great value to humanity and appreciated by the surgeon.

BLOOD TRANSFUSION

The development of blood transfusion has been an interesting surgical procedure. The early direct methods of joining an artery of the donor to a vein of the recipient required a delicate operative maneuver. This has gradually been replaced by more simple methods. Whole blood collected in large paraffined glass tubes was a great advance. Citrated blood finally became generally adopted and is still in use in most clinics. Many ingenious mechanical devices for blood transfusion were brought out and some of them have found favor. Now the development of blood and plasma banks are popular. The heated discussions in the sectional meetings on the advantages of the whole blood method over citrated blood and vice versa now seem irrelevant but it is only by such interchange of experiences that advances can be made.

FRACTURES

The general surgeon is still called upon to treat fractures of the bony skeleton. He relinquishes his interest in this field to the orthopedic surgeon with great reluctance. Standardization of treatment of these lesions is not easy to bring about. Doubtless, there are many useful methods. Some are better adaptable to the general surgeon in a rural community, while others are suited to a large urban clinic. The end results are not always perfect in either case but there has been a steady, gradual improvement in the treatment of fractures throughout the country. Contributions on the subject are still offered in the surgical as well as in the orthopedic sections. In 1939, the two sections combined their programs for one session to the enlightenment of all concerned.

THE CANCER PROBLEM

All branches of medicine have contributed to the cancer problem. From the hopeless viewpoint held only a few decades ago, we have come a long way. Surgeons have welcomed all aid in this field but still must use their skill in the treatment of many forms of this disease. Radiologists have demonstrated that they can often produce a better result with less mutilation than the surgeon. Gradually, there has come about a combined effort in treating the lesion in certain areas of the body. There are still many questions to be settled in this regard but there is a cooperative spirit that will bring about a better situation. Cancer of the breast, when treated by radical operation, can be cured in a specific percentage of cases. Early presentations on this subject by Halstead, Rodman and Richardson are as sound today as they were a quarter of a century ago. Radiation may supplant surgery in this field of cancer and now is looked upon as an important adjunct.

Cancer of the gastrointestinal tract has been one of the chief topics of discussion in many of our meetings. The increase in the knowledge concerning this disease has brought about a better understanding of its development, its early manifestations,

Medical School of The University of Pennsylvania from 1765 to 1802 known as Surgeon's Hall.

the mode of its spread, and consequently, its complete extirpation. The improvement in diagnostic methods, the preparation of the patient, anesthesia and surgical technic have made it possible to cure many of these patients. A free interchange of ideas and the careful study of end results have brought about some standardization of the methods at our disposal. It is obvious when one looks over many of the presentations on this subject that there are many useful procedures. The conditions under which he works and his adaptability to certain types of surgery make it necessary for each surgeon to use a method that in his hands gives a satisfactory result. Too much has been said about the terrible afflictions of a permanent colostomy, the result of which has spelled the doom of many useful citizens. Thousands of happy people, leading otherwise normal lives, are colostomy patients. Since operation for cancer of the large bowel and rectum offers approximately a 50 per cent chance for a five-year cure and often a worth while shorter respite, it is surprising that there can still be any hesitation on the part of the profession to offer relief to this group of patients.

NEUROSURGERY

Surgery of the brain and spinal cord has developed almost entirely in the past three decades. Many of Harvey Cushing's earlier experiences in this field were reported before the surgical section of the Association. Although now there are many neurosurgeons who devote their entire time to this specialty, we find that the general surgeon is still interested in the subject. This is true of many other subdivisions, particularly genitourinary, gynecologic and thoracic surgery. All were begun by general surgeons and the frequent overlapping of interests, at present, is beneficial. One cannot become limited to a viewpoint so narrow that more important aspects of the problem are lost.

Early surgery was of the emergency type. The repair of traumatic wounds, amputations and the drainage of abscesses comprised the major part of the surgeon's work. As knowledge of pathology and bacteriology increased along with safe anesthesia, operations of an elective nature rapidly developed. Removal of tumors and the repair of hernia were among the earlier procedures successfully attempted. As experience grew through trial and error and finally by animal experimentation, there gradually came about a logical approach to remediable lesions in all parts of the body. Progress was slow in some fields but as new developments were brought to light, they were at once subjected to criticism which resulted in their proper evaluation.

One cannot help but feel that this last half century has been a most alluring one from the surgeon's viewpoint. So much has been accomplished that the medical student often wonders whether there is anything left for him in surgery save to become an excellent technician. Little does he realize that, although a certain standard of perfection does exist, there are endless important problems in this field as yet unsolved. That fifty years from now our successors may look with some amusement on our 1941 state of knowledge is the hope we hold for the future of humanity.

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SIGNIFICANCE OF THE AMERICAN COLLEGE OF SURGEONS TO PROGRESS OF SURGERY IN AMERICA

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IN the light of the present status of the American College of Surgeons, it seems incredible that its launching by Franklin H. Martin and his associates in 1913 should have brewed the tempest it did. The tempest, however, is part of the story, and perhaps one of the reasons that make the story of the College so interesting to tell and to hear is that the reactions of the characters who figured in it were so violent, either in favor of or against the organization.

Blasts like the following warmed the pages of professional publications in 1913 and 1914:

"Here it is at last, a full-blown attempt by would-be conspicuous members of the home profession to engraft upon the democratic tree of free American medicine a royal sprout of would-be aristocracy from 'Old London Town.' . . . But the great American profession has a temper all its own, founded upon self-respect, and a democratic love of fairness, and a dislike for all counterfeits. How well this latest attempt to build up an oriental oligarchy for the purpose of controlling honors, titles, offices and, incidentally, business, is to be received by this progressive profession in the West, remains to be seen. There is more than an intimation in the air that many a man with the label of F.A.C.S. on him will be ready eventually to sell it very cheap."

Another surgeon ended a long communication to an editor with the following paragraph:

"Some unthinking surgeons, dazzled by the display of red fire and confused by the discharge of blank cartridges, have been actually stampeded into joining this college at its recent inauguration in Chicago, fearing lest they might otherwise lose out. A good many more, who had been almost persuaded, received enlightenment in time, and wisely withheld their applications."

The tempest has long since been quieted. Eagerness to co-operate with other organized groups was shown by the College, and in the years since its founding, it has had their help in waging an earnest fight to further the aims stated by John M. T. Finney of Baltimore.

"To put down corruption and graft, to cleanse our professional escutcheon of the foul blots with which it is stained, to elevate the ideals and the whole tone of the profession, to encourage research and study, to increase the efficiency and to raise the standard of every individual surgeon."

Blessed with aggressive leaders and stimulated by the imagination and tireless energy of Franklin H. Martin, the American College of Surgeons has proved itself to be one of the most potent forces for progress in surgery today.

The College developed as the logical sequence to a series of events, a recounting of which properly belongs in its story, since only in this way can the spirit of the founders and the manifold activities in which it has engaged be understood.

1. *Surgical Journal Edited by Active Surgeons Initiated.* The first of the preliminary events was the starting on July 1, 1905, of *Surgery, Gynecology and Obstetrics*, as a result of Dr. Martin's conviction that there was a place for a practical journal for practical surgeons, edited by active surgeons. Nicholas Senn headed the Editorial Board, with Dr. Martin as Managing

Editor and Allen B. Kanavel as Associate Editor. The immediate success of this publication was proof that "the profession preferred to receive information directly from practicing surgeons rather than from non-practicing editors." This conclusion led logically to the idea that "it would be far better to have a practicing surgeon *demonstrate* his work than to have him tell about it."

2. *Journal Invites Its Subscribers to Clinics.* Following this conviction with action, the Editorial Board of *Surgery, Gynecology* and *Obstetrics* arranged for a group of surgical clinics in Chicago to which it invited its subscribers, from November 7 to 19, 1910.

"It was an innovation," commented Dr. Martin, "that the academic orators and medical politicians watched with amusement that they did not conceal; but it stirred in the minds of practical surgeons a hope that the advantages of the Society of Clinical Surgery (founded in 1903 by a select group) were now to be extended to all progressive specialists. At any rate, many of them evidently decided that they would see for themselves, as thirteen hundred men registered on the opening day."

Those in attendance at the clinics expressed a desire to perpetuate them. The keynote was struck by John B. Murphy, then and always Dr. Martin's staunch supporter:

"Hearing papers and reading papers is one thing. Seeing men do things is another. We all know that no such benefit can be derived from hearing papers read as one can obtain from seeing the work done right before us. When you see and hear it in the latter way, it is a part of yourself. When you hear it read, it is still the author's although a small part of it has been absorbed by yourself."

3. *Clinical Congress of Surgeons of North America Organized.* There followed then in logical sequence a meeting on permanent organization, on November 18, 1910. At this meeting Albert J. Ochsner was elected president following his nomination by John B. Murphy; and the organization was formally completed and named the Clinical Congress of Surgeons of North America. The second Congress was held in Philadelphia, November 7 to 16, 1911, with fifteen hundred doctors enrolled, and the third in New York, November 11 to 26, 1912, with twenty six hundred doctors registered during the first two days and hundreds more in attendance who had not registered.

At a meeting with the New York committee to prepare for the third Clinical Congress, it became apparent that it would be necessary to limit attendance at clinics to registered members, and to choose wisely the clinics and clinicians who were to be scheduled for presentation.

4. *Idea of Organization to Control Attendance Conceived.* Event number four was the conception by Dr. Martin of the plan for a new organization through which definite qualifications for membership would be established. This plan, presented by him at the business meeting of the Congress on November 15, 1912, was enthusiastically endorsed by Dr. Murphy, and unanimously approved by the two thousand surgeons present.

5. *Idea of Qualifying Purpose of Organization Broadened.* The fifth development was recognition that the need for qualifying surgeons in general was far more important than simply to control attendance at the Clinical Congress. The necessity for approving hospitals and clinics for the common good of both surgeon and public was paramount to selection of creditable institutions in which to hold the clinics. Out of considerations such as these, and with the support of John B. Murphy and Edward Martin, Dr. Martin drew a plan for the establishment of an American College of Surgeons which involved the setting of professional, ethical and moral standards for membership. A special degree, documentary evidence of such a degree and publication of membership lists were among the original proposals approved by the Clinical Congress. A committee of twelve was appointed to proceed with the organization. These men were:

Edward Martin, Philadelphia
Emmet Rixford, San Francisco
John B. Murphy, Chicago
Rudolph Matas, New Orleans
Albert J. Ochsner, Chicago
Charles H. Mayo, Rochester
Frederic J. Cotton, Boston
George Emerson Brewer, New York
John M. T. Finney, Baltimore
Walter W. Chipman, Montreal
George Crile, Cleveland
Franklin H. Martin, Chicago

6. *Clinical Congress Initiates Hospital Standardization.* The Clinical Congress at this same meeting (November, 1912) acted on a proposal by Allen B. Kanavel that was destined to develop into one of the most important activities of the future college. Dr. Kanavel's proposal was:

"Some system of standardization of hospital equipment and hospital work should be developed, to the end that those institutions having the highest ideals may have proper recognition before the profession and that those of inferior equipment and standards should be stimulated to raise the quality of their work."

The committee appointed to carry out the spirit of this resolution was headed by Ernest Amory Codman of Boston, who had already gone on record as favoring standardization of hospitals. Dr. Codman made progress reports to the Clinical Congress in 1913 and 1915.

7. *Clinical Congress Initiates Public Education in Cancer Control.* Of far-reaching importance, both as presaging an activity of the future College and as influencing progress in the fight against cancer, was the creation at this same 1912 Congress, at an evening program given over to a consideration of cancer of the uterus, of a committee of five, with Thomas S. Cullen of Baltimore as chairman, to wage a campaign of publicity to acquaint the people of the country with the fact that in the early stages of cancer a large proportion of patients can be cured by operation. Commenting on the creation of this committee, an editorial in *Surgery, Gynecology and Obstetrics* in January, 1913, said in part:

"The committee was explicitly instructed to write or have written popular articles on the subject of cancer and to have these published in the daily press, the weekly or monthly magazines, or journals as was deemed most expedient. In the course of a year it is hoped that the people of the United States will be able to find, in the current literature that they are accustomed to read, simply written articles on every variety of cancer about which they should have a clear knowledge."

The manner in which this campaign was carried forward is a striking example of effective co-operation. The American Gynecological Society also had a committee on cancer. The following spring this committee presented to certain public spirited women of New York the need of a national organization whose sole purpose would be education of the public. The idea having been favorably received by the women and prominent surgeons, the Committee presented it at the Congress of Physicians and Surgeons in Washington, the week of May 4. Following the endorsement of this body, the American Society for the Control of Cancer was organized on May 22, 1913, to conduct the same kind of campaign with which the Clinical Congress had charged its Cancer Committee. Thereafter, the Society and Committees from the American Gynecological Society, the Clinical Congress (later the American College of Surgeons), and the American Medical Association co-operated to further this work and are doing so to this day.

THE GROUNDWORK FOR THE COLLEGE IS LAID

At the Clinical Congress of 1912, therefore, the shape, aims and individuality of the future American College of Surgeons appeared in somewhat nebulous form. As a clinical surgical society, it had the Clinical Congress with its yearly sessions, including practical demonstrations and scientific papers. As an accrediting board, the proposal was made to establish an American College of Surgeons. Its desire to stimulate betterment of hospital facilities for surgeon

and patient was evidenced in the hospital committee appointed by the Congress. The interest in clinical research was presaged in the cancer meeting. Responsibility to the surgeon and prospective surgeon was shown in the desire to improve hospitals, and thereby to increase educational facilities and opportunities. Responsibility to the public was expressed in the intention to publish lists of accredited surgeons, to educate the individual to seek early treatment for cancer and to establish standards of hospital service. To one studying the College today, these early stages assume great significance both as indicative of the broad vision of the founders and of the vitality with which the initial purposes have been carried out and sustained.

With acute foresight, Franklin Martin realized that opposition to such an organization would develop regardless of its merit or the sincerity of its founders. With the authority of the Clinical Congress and the Committee on Organization, an Illinois Charter was obtained November 25, 1912, and Doctor Martin devoted much of his time from then until the following May in presenting the plan to some five hundred surgeons in the United States and Canada. His accounts of these meetings as they appear in his "The Joy Of Living" make interesting and stimulating reading and give insight into the sincerity and persistence of the man. It would appear from his accounts that the College and the ideas it represented were enthusiastically supported and appreciated by the younger members of the surgical profession of his day, and that the encouragement and support of many men of vision in the older group gave the project authority.

THE COLLEGE IS FOUNDED

Of the 500 surgeons invited to serve as founders, 450 came to the meeting at Washington, D. C., on May 5, 1913, at which were presented the plans for the organization, the proposed by-laws and the charter. The by-laws were accepted, resolutions were passed, and the following officers were elected:

John M. T. Finney, Baltimore, President
Walter W. Chipman, Montreal, Vice President
Rudolph Matas, New Orleans, Vice President
Albert J. Ochsner, Chicago, Treasurer
Franklin H. Martin, Chicago, Secretary General

The original Board of Governors, as provided in the by-laws, consisted of the surgeons invited by the Organization Committee to serve as Founders of the College. The Governors elected from among their number the following Regents:

George E. Armstrong, Montreal
George E. Brewer, New York
Herbert A. Bruce, Toronto
Frederic J. Cotton, Boston
George Crile, Cleveland
John M. T. Finney, Baltimore
William D. Haggard, Nashville
Edward Martin, Philadelphia
Franklin H. Martin, Chicago
Charles H. Mayo, Rochester
Robert E. McKechnie, Vancouver
John B. Murphy, Chicago
Albert J. Ochsner, Chicago
Harry M. Sherman, San Francisco
Charles F. Stokes, Washington

These with vice-presidents, Chipman and Matas, constituted the first Board of Regents.

FEE-SPLITTING PROHIBITED

It is significant that at the meeting which made the American College of Surgeons an assured fact and even before it had begun to function, a declaration against the division of fees was adopted as a cardinal principle. So strong was the feeling that the College should fight this practice, that Dr. Martin had to urge that this battle be conducted as part of, but not dominate, the positive purpose to "elevate the standard of surgery."

The stand against fee-splitting has been firm and probably no one ethical qualification of a candidate receives so much scrutiny as that which has to do with the division of fees. While important in itself,

this consideration serves also to focus attention on the fact that in judging qualification for fellowship the ethical standing receives equal consideration with the professional. The College also has a lever against fee-splitting even outside its fellowship. It has made one of the conditions of its approval of hospitals the enforcement of rules and regulations against division of fees by any members of the staff.

EARLY YEARS

The first convocation, at which 1,059 surgeons were admitted to fellowship, was held in the Gold Room of the Congress Hotel in Chicago on November 13, 1913, and the ritual and procedure were patterned largely after similar formalities of the Royal College of Surgeons of England, Scotland and Ireland, which had, in so far as conditions were comparable, served as the model for the American College. Sir Rickman J. Godlee, of London, then president of the Royal College of Surgeons of England, brought official greetings of that body and delivered the Fellowship Address. He received the first honorary fellowship in the new College.

The Clinical Congress was continued more or less independently until 1917, when it was merged with the College which has since controlled it as a self-sustaining activity.

At the first six convocations, a total of 3,795 candidates were received into fellowship. Three main developments stand out in this period, as follows:

1. The plan for a hospital program began to take form.

2. In 1915, an International Committee on Standards was formed to consider ways and means to create, (a) supplementary and graduation training for surgeons; (b) legislative enactment and other means to prevent dishonest practices; and (c) enactment of laws to protect the public against untrained surgeons.

3. Pre-war preparations and then the war itself checked activities and imposed emergency planning and work.

The Sixth Convocation held in Chicago, October 26, 1917, was a great military gathering, hundreds of the medical officers in the service of the Army and Navy being present on leave. The Fellowship Address was delivered by Sir Berkeley Moynihan, Colonel in the Royal Army Medical Corps of England. Doctor Martin had deliberately planned to utilize this occasion for a war meeting to demonstrate the country's further need for medical officers. Again he enlisted the aid of the spectacular to create an impression and was successful. Present were the Surgeons General of the Army, the Navy and the Public Health Service. President Wilson sent a telegram of greeting, and Secretary of the Navy, Josephus Daniel, was a surprise speaker. A martial note was also given by John Philip Sousa and his band from the Great Lakes Naval Training Station.

Doctor Martin was one of the seven members appointed by President Wilson to the Advisory Commission of the Council of National Defense. He was interested in the establishment of medical advisory boards and in campaigning for the enrollment of medical officers. Ninety per cent of the Fellows of the American College of Surgeons enrolled for war service—40 per cent in the Medical Corps of the United States and Canadian Armies, 10 per cent in the Navy Medical Corps and 40 per cent in the Volunteer Medical Service Corps of the United States. Fellows of the College headed the greater percentage of the forty-two base hospitals organized for service over-seas. Many of these were composed of surgeons and other medical and nursing personnel from one institution, and many of the enlisted men were drawn from the undergraduate body of an affiliated university. The idea for such a unit emanated from Doctor Crile, then a vice-president of the College. Several of these base hospitals reached England and France before any other American soldiers.

Eleven years after the war when time had made it possible to evaluate some of the accomplishments, Merritte W. Ireland,

Surgeon General of the United States Army, in his Inaugural Address as president of the American College of Surgeons, said that the results of the surgery of the war were far better than those of any previous war. He said that despite the fact that two-thirds of the wounds were made by explosive missiles, 90 per cent of the wounded were saved, and that the advances in the treatment of deformities in orthopedic, plastic and head surgery could scarcely be estimated. We may be sure in retrospect that not a little of this result praised by the Surgeon General was attributable to the good fortune that made American surgery an organized unit at the time war struck.

As an aftermath of the war, another of those dramatic events occurred that lend color to the history of the College. At the tenth session of the Clinical Congress held in Montreal in 1920, a committee representing the consulting surgeons of the British armies presented to the American College of Surgeons the Great Mace designed to tell in a symbolic way of the close union between British and American surgery and of the ties which unite Great Britain to Canada and to the United States.

REPRESENTATIVE CHARACTER OF THE COLLEGE

It would be impossible to separate the story of the progress of American surgery since 1913 from that of the progress of the American College of Surgeons. One reason for this is that those who have led the College have always had a larger purpose than advancing that organization; their spirit has been one of service to surgery. Another reason is that the organization is in a large degree a compound of other surgical societies, and its activities are interwoven with those of all groups working to advance educational, ethical, scientific and humanitarian standards of medicine. This heterogenous character is shown by the fact that twenty surgical associations and societies are entitled to nominate each year one Fellow to serve for the three years as a candidate for the Board of Governors. These are:

American Surgical Association
Surgical Section of the American Medical Association
Section on Obstetrics, Gynecology, and Abdominal Surgery of the American Medical Association
American Gynecological Society
Southern Surgical Association
Western Surgical Association
Section on Surgery of the Canadian Medical Association
American Association of Obstetricians, Gynecologists, and Abdominal Surgeons
American Orthopedic Association
American Academy of Orthopedic Surgeons
American Association for the Surgery of Trauma
American Association of Genito-Urinary Surgeons
American Urological Association
American Laryngological Association
American Ophthalmological Society
American Otological Society
American Institute of Homeopathy
Pacific Coast Surgical Association
Medical Corps, United States Army
Medical Corps, United States Navy

Since the Board of Regents, which controls and manages the affairs and funds of the College, is elected by the Board of Governors, it is obvious that a truly representative organization has been achieved. This is further evidenced by the fact that geographic representation is provided through a policy of having as many governors for each state, province and foreign country as would be proportionate to its number of Fellows. With 150 governors and a fellowship of around 13,000, the representation averages about one governor to each ninety Fellows in a geographical division. The nominations by the surgical societies sometimes unbalance the geographical distribution, but a means of adjustment is provided through the elections from the general fellowship.

THE FELLOWSHIP PLEDGE

The fellowship pledge, little changed from the wording adopted in 1913, is

broadly indicative of the purposes of the organization:

Recognizing that the American College of Surgeons seeks to develop, exemplify, and enforce the highest traditions of our calling, I hereby pledge myself, as a condition of Fellowship in the College, to live in strict accordance with all its principles, declarations, and regulations. In particular, I pledge myself to pursue the practice of surgery with thorough self-restraint and to place the welfare of my patients above all else; to advance constantly in knowledge by the study of surgical literature, the instruction of eminent teachers, interchange of opinion among associates, and attendance on the important societies and clinics; to regard scrupulously the interests of my professional brothers and seek their counsel when in doubt of my own judgment; to render willing help to my colleagues and to give freely my services to the needy. Moreover, I pledge myself, so far as I am able, to avoid the sins of selfishness; to shun unwarranted publicity, dishonest money-seeking, and commercialism as disgraceful to our profession; to refuse utterly all money trades with consultants, practitioners or others; to teach the patient his financial duty to the physician and to expect the practitioner to obtain his compensation directly from the patient; to make my fees commensurate with the service rendered and with the patient's rights; and to avoid discrediting my associates by taking unwarranted compensation. Finally, I pledge myself to co-operate in advancing and extending, by every lawful means within my power, the influence of the American College of Surgeons.

SELECTION OF FELLOWS

The College early overcame the opposition on the score of exclusiveness by demonstrating the sincerity of the announcement by the Board of Regents that it would be the "spirit of the Association to open the fellowship to all competitors in surgery without favor." Applicants for fellowship are thoroughly examined and investigated, not only in respect to professional qualifications, but ethical as well, and a conscientious attempt is made properly to evaluate a man, on the basis of all obtainable data. Applications to fellowship are studied by Committees on Credentials, consisting of a Central Committee which reports to the Board of Regents and State and Provincial Committees which report to the Central Committee. After examination of candidates' records and references, the Committees make recommendations as to eligibility. There have recently been added in a number of cities and states, Committees on Applicants which personally interview and investigate all applicants before they are considered by the Credentials Committees.

In the beginning, rigid educational requirements could not be enforced. As time has passed the influence of the College, more than any other single factor, has increased opportunities for education and training; and it has been possible to define more specifically the requirements for fellowship, and to raise them from time to time. They now specify graduation from an accepted medical school; a year of internship in an acceptable hospital; at least two years spent as surgical assistant or apprentice (applicants whose medical degree has been obtained since January 1, 1938, must have completed three years of hospital service of which two years have been spent in training in surgery in approved hospitals); seven years after graduation in medicine devoted to special training and to practice; submission of one hundred case records of major surgical work, including at least fifty cases for which the candidate was the responsible surgeon; and approval by the Credentials Committees after determination of the applicant's moral and ethical fitness, by reports of surgeons whose names are submitted by the applicant, and by such other information as the Committees and the Administrators of the College may obtain.

JUNIOR CANDIDATES

A Junior Candidate Group was formed in 1923 at the suggestion of John Wesley Long of Greensboro, North Carolina. The purpose of this group is to bring the younger medical graduates, who intend to

enter the surgical field, under the influence of the ethical and educational standards promulgated by the College. Any legalized practitioner of medicine who has been graduated from an approved medical school for a minimum period of two years, and not more than seven years, and who plans to specialize in surgery may apply. The College requires formal application, other information such as is exacted from the applicant for fellowship and a signed declaration against the division of fees. A Fellow of the College is appointed to act as Counselor to each Junior Candidate endorsed by the Credentials Committee. Members of the Junior Candidate Group are eligible to attend the Clinical Congress and Sectional Meetings of the College. They are acceptable as Fellows only after they have met the requirements for fellowship.

GEOGRAPHIC DISTRIBUTION OF FELLOWS

Doctor Martin makes reference in his book to the fact that the American College of Surgeons is not in Chicago, but in every community on this continent and South America where the Fellows of the College reside and practice their profession. An important factor in decentralization is the holding of sectional meetings, or miniature Clinical Congresses, every year in various groups of states and provinces. These serve to bring together the Fellows and their confréres and those interested or engaged in hospital work.

Surgeons of Canada were among the founders of the College and have always been active in its direction and work. In 1915, a number of Latin American surgeons petitioned for admission to fellowship. The war delayed action, but in 1920, Doctor Martin and William Mayo, then president, made a trip to Latin American countries, visiting the surgeons of Panama, Peru, Chile, Argentina and Uruguay. As a result of this and later visits by representatives of the College, eighteen Latin American countries are now represented, each having its Committee on Credentials, and fellowships have been conferred upon 321 surgeons from Latin America.

MAJOR ACTIVITIES—HOSPITAL STANDARDIZATION

The war interrupted the regular activities of the College, but it also furnished a stimulus to some of them. Among these was Hospital Standardization.

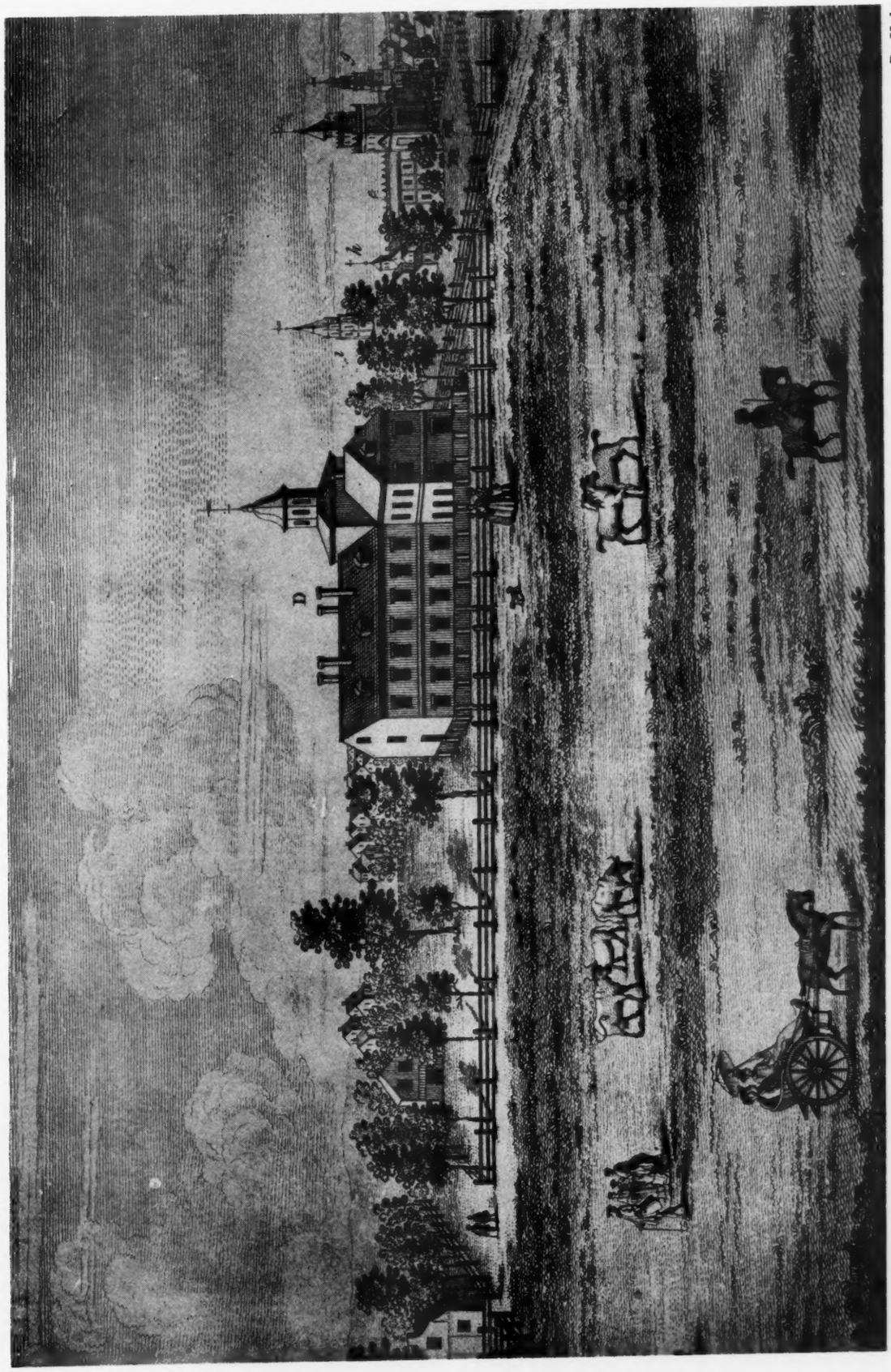
In an article in the 1917–1918 Year Book, the effect of the War on Hospital Standardization was interpreted as follows:

> "With some impatience the Fellows of the College looked forward to an active campaign throughout the continent for the betterment of hospitals. Then came the war and its quick effect to vitalize a high ideal of service not only in the profession and among hospitals, but throughout every phase of our national life. In the fluid state of mind thus created, soldiers, sailors, and the general public realized with new force that they are entitled to the best in medical science; and the profession in turn by this awakening was struck with a keener sense of the debt which the practice of medicine demands. Almost in a single morning all shadows of doubt as to whether a continent-wide standardization of hospitals could be entered into with continent-wide good will were cleared away."

The hospital program was endorsed by the American Hospital Association on September 27, 1916, and a committee was appointed to co-operate in its furtherance. The officers of the Catholic Hospital Association, together with His Eminence, James Cardinal Gibbons, also endorsed, on January 11, 1917, the proposed standardization plan and offered their co-operation and aid. Likewise, the Protestant Hospital Association, the Board of Hospitals and Homes of the Methodist Episcopal Church and the Baptist Hospitals gave enthusiastic support.

THE MINIMUM STANDARD FOR HOSPITALS

In March, 1918, after considerable study and analysis, the College distributed to hospitals and the Fellows a bulletin en-



Pennsylvania Hospital Chartered in 1751—Building Designated by the Letter "D" is the Hospital

titled, "Standard of Efficiency for the First Hospital Survey." During the years 1918 and 1919, field representatives visited 671 hospitals of 100 beds or more in the United States and Canada, and of these eighty-nine were approved as meeting the Minimum Standard in 1918, and 198 in 1919.

The program won public notice. "World's Work" assigned a writer, Mr. Hawthorne Daniel, to report upon it, and his article, published in the June, 1920, issue, included the following remarks concerning the Minimum Standard:

"The statement is simplicity itself, and yet, with all of its simplicity it contains just the suggestions that go to make good hospitals of mediocre ones; just the suggestions that lead to the conservation of lives and the elimination of unnecessary operations; just the suggestions that bring about the conscientious care that every patient in every hospital has a right to expect.

"From coast to coast the idea is changing the conditions in hospitals. Everywhere there is the ferment of development, the activity of improvement. In great centers of medical affairs the changes have been startling. In Baltimore, the greatest center of medicine in America, there is not a hospital of 100 beds or more that has not put into effective operation the Minimum Standard.

"In New York and other cities the hospitals have made almost as great an advance. The world of the hospital is changing. An advance normally to be expected in twenty years has come in three. For this opinion I am indebted to President Henry E. Pritchett of the Carnegie Foundation."

The Minimum Standard for Hospitals has five clauses having to do with (1) organization of the medical staff; (2) qualifications of medical staff members; (3) holding of medical staff conferences for the purpose of review and analysis of cases; (4) keeping of accurate and complete medical records; and (5) diagnostic and therapeutic facilities. Although only minor changes have been made in the wording since it was formulated in 1918, it remains completely modern because it is a statement of principles rather than of details of application, and the interpretation has advanced with hospital progress. To the basic standard have been added sixteen Minimum Standards covering distinct departments or services in the hospital, namely, (1) clinical laboratories; (2) *x*-ray departments; (3) surgical departments; (4) departments of anesthesia; (5) obstetrical departments; (6) eye, ear, nose and throat departments; (7) treatment of fractures; (8) traumatic surgery; (9) cancer clinics; (10) physical therapy departments; (11) outpatient departments; (12) pharmacies; (13) nursing services; (14) dietary departments; (15) medical social service; and (16) medical library.

Approval Procedure. Each year every hospital under survey is reconsidered for approval in the light of the reports and other late information available. Representatives are constantly in the field surveying hospitals and gathering information about them. Announcement of the Approved List is made officially at the Hospital Standardization Conference held in connection with the Clinical Congress each year. The list is published in the Approval Number of the College Bulletin. Approved hospitals receive certificates for display.

Clearing House of Information on Hospitals. The College now has in its files more than 50,000 reports of Hospital Standardization surveys—an invaluable mine of reference material, tremendously illuminating in showing the steady advance of hospitals, singly and collectively—as the process of survey, reporting recommendations back to the hospital, follow-up and re-survey have persistently gone on year after year. The reports form the foundation of an accumulation of reference material on hospitals which is utilized by them and by various associations.

Hospital Standardization Conferences. Hospital Standardization Conferences are held each year in connection with the Clinical Congress. They consist of general sessions, panel discussions, round table conferences, consultations, demonstrations in the local hospitals and exhibits. The

conferences, attended chiefly by hospital administrators and heads of departments in the hospital, also attract medical staff members, some of whom are always included in the program to present papers dealing with various phases of hospital service and to take part in the panel discussions. Similar conferences are held in connection with Sectional Meetings.

Co-operation with and by Hospitals. Hospital Standardization has been a self-imposed task and it has been carried forward at great expenditure of time, energy and funds. All expense except an original grant of $105,000 from the Carnegie Fund has been borne by the College. The hospitals in general have welcomed criticisms and suggestions, and a program that might have made enemies for the College has been one of its chief means of building good will since the work has been done in a spirit of service to the hospital, the surgeon and the patient. The benefits are of course directly shared by the internist and all other members of the professional and administrative staffs. Improved hospitals mean improved surgical results, but they also mean higher standards of care for all types of patients.

The co-operation of the hospitals in this voluntary movement is shown by the fact that in 1940 a total of 2,806 hospitals having twenty-five beds or more were approved, out of 3,677 under survey. Of hospitals having 100 beds or more, 1,853 out of 1,986, or 93.3 per cent, are approved.

WIDE RECOGNITION OF HOSPITAL STANDARDIZATION

It is noteworthy that the Hospital Standardization program was endorsed at the Third Pan-American Scientific Congress held in Lima, Peru, in December, 1924, and that upon request, surveys were made of about forty hospitals in South America and several were placed upon the Approved List. In 1926, Malcolm T. MacEachern, Associate Director in charge of hospital activities, was loaned by the College to Australia and New Zealand at the request of their governments and the British Medical Association of both countries, for the purpose of advising with them regarding future policies and development of their hospitals. While there, he laid the foundation for the remodeling of their institutions along the lines laid down by the Minimum Standard of the College.

In 1929, Hospital Standardization was the subject of special discussion at the Pan-Pacific Surgical Congress in Honolulu. It has been presented and discussed at several meetings of the International Hospital Association, of which Dr. MacEachern has been president since 1938. In 1940, it was among the subjects discussed at the First Inter-American Conference on Hospital Administration held in Puerto Rico.

It is neither possible nor desirable to avoid tracing the success of a program of this kind to the individuals who are responsible for its direction. The pioneer work has been mentioned. The Minimum Standard was drawn up by the Director of the College in 1918, John G. Bowman, now Chancellor of the University of Pittsburgh. Since 1921, the Department of Hospital Standardization has been headed by Dr. MacEachern, an experienced hospital administrator, who has won prestige and good will for his organization by his whole-souled devotion to the cause of better hospitals. Active also in the work of Hospital Standardization is Assistant Director Earl W. Williamson, who joined the organization in 1922.

CLINICAL RESEARCH

The idea of conducting clinical research originated in the Clinical Congress of Surgeons of North America before the College was organized. As has been mentioned, the Congress in 1912 appointed a committee to disseminate information about cancer to the public. In his report the following year the chairman, Dr. Cullen, after telling of the numerous articles that had appeared in leading magazines and newspapers and of their already noticeable effect in bringing patients to seek treatment earlier, said:

"Your committee finds that accurate data on cancer in the United States are very meager. If the people of the land are to be enlightened, we must keep better records. . . . With the increased number of cancer patients coming early for operation the percentage of cures will naturally be increased and with the improved methods of operating this percentage will be still further improved. It is this continued increase in the number of permanent cures that we must keep continually before the public."

That was the germ of the idea that ripened in 1930 into the archives for five-year cancer cures. More than 30,000 five-year cures are now recorded, constituting one of the strong arguments in the "Cancer is Curable—Fight it with Knowledge" campaign in which the College and other organizations are co-operating with the American Society for the Control of Cancer. The work which led to the establishment of the archives was begun in 1922 by a committee under the chairmanship of Robert B. Greenough. Its first activity was to assemble from selected clinics as many accurate and complete records as possible of cancer of the cervix and of the breast. In July, 1924, Dr. Greenough reported on the three-year results of treatment of cancer of the cervix, and in August, 1929, on five-year results of cancer of the cervix and breast. These individual cases were reported on special record forms. Other forms have been added until there are now twenty-three for cancer of different parts of the body, widespread adoption of which is doing much to improve cancer records and to secure comparable statistical material from many sources.

In 1921, at the instigation of Ernest Amory Codman, the Registry of Bone Sarcoma was established. No better example of a concerted, co-operative study of one subject exists. More than 2,200 cases have been registered with complete histories. Annual follow-ups on these cases have been continuous and almost complete. Each case has been studied by a dozen or more members of the committee and others, and the independent opinions of each are recorded. Annual reports have been issued and a considerable number of published studies on bone tumors have been based on the Registry material, which has also served in medical schools and other centers for demonstration purposes and personal and group studies. A uniform classification of bone tumors was adopted in 1923, revised in 1928 and again in 1939; it has been adopted by surgeons, pathologists and radiologists throughout America and other countries, introducing uniformity into a previously chaotic field. The work of the Registry has resulted in more accurate diagnoses and more effective treatment of bone tumors. The diagnosis of benign tumors, for instance, some of which were formerly considered malignant, has saved many limbs which might otherwise have been sacrificed, and new entities have been discovered and described and information about them disseminated.

An important result of the Bone Sarcoma Registry has been the example set in accurate and complete follow-up and recording of cases, which has been imitated in many registries of various kinds of surgical and medical cases now in existence.

As Dr. Martin said in connection with the starting of clinical research activities, great universities and philanthropic foundations and individuals of wealth have invested vast sums in support of scientific research, but clinical research has been neglected. The College entered a field which he called "unlimited in extent, unappropriated, and of inestimable value to the actual practice of medicine."

In charge of the Department of Clinical Research since 1926 has been a practical pathologist, Dr. Bowman C. Crowell, associate director of the College, who had won distinction in the teaching field before he joined the organzation. In addition to clinical research, which is largely concerned with cancer, he has under his direction the activities in connection with the organization of cancer clinics, with standardization of medical service in industry, and with the

improvement of the treatment of fractures and other traumas.

CANCER CLINICS

In 1927, the Amercan Society for the Control of Cancer appointed a committee consisting of Dr. Ewing, Dr. Greenough and Dr. Gerster, to report on the best method of improving service to the cancer patient. In 1929, that committee reported on the medical service available and made suggestions for its improvement, among which was a more widespread organization of cancer clinics in general hospitals. The offer of the American College of Surgeons to develop the cancer clinic idea was welcomed. The College, therefore, formulated in 1930 a Minimum Standard for cancer clinics in general hospitals and offered recommendations for their formation. The purpose of these clinics was to furnish the patient with all available diagnostic and therapeutic measures, to furnish authoritative data of a comparable nature from clinic to clinic and to act as a clearing house of information for a united fight against cancer.

Surveys of existing facilities were begun in 1931, and in 1932 the College announced the first list of 100 approved cancer clinics. On the October, 1940, approved list there were 345 clinics, constituting 23 per cent of the approved general hospitals having 100 or more beds. Through the approved clinics there passed in 1939 a total of 78,000 patients who benefited by the group consultation in diagnosis and treatment. The College believes that at least 40 per cent of hospitals having 100 or more beds should have organized cancer clinics in order to provide adequate service.

Through its work of encouraging the formation and establishment of standards for cancer clinics, the College has earned recognition as the national organization which is doing the most constructive work in the clinical control of cancer. The Advisory Cancer Council, through the National Cancer Institute, has extended grants-in-aid for the past two years to help cover the expense of some of the surveys.

In every case in which a state has taken measures to control cancer, recognition has been given to the College standards, sometimes to the extent of requiring College approval of clinics before state aid will be granted. Advice from the College has been sought by all of the states in planning their work.

MEDICAL SERVICE IN INDUSTRY

Activities in the field of medical service in industry developed from the work in Hospital Standardization. The initial impetus came from the chairman of the Medical and Surgical Section of the American Railway Association in 1920, Dr. Daniel Z. Dunott of Baltimore. At his instigation the Railway Association adopted on November 16, 1921, a resolution providing that:

> "Whenever possible only hospitals rated as Class 'A' by the American College of Surgeons be recognized, and when railroads have their own hospitals, such institutions not already so classified be brought to such standard."

Afterward Dr. Dunott asked:

"Why doesn't the College do for industrial surgery what it did for hospitals?"

The question was answered with investigations of medical services in the lumber mills of the West, in the oil fields of the South and in the industrial plants in New York City. Since the findings disclosed a great need for higher standards, a committee with Frederic A. Besley as chairman was appointed in 1926 to work toward better organization and service in caring for the ill and injured in industry, for the elimination or control of industrial health hazards and for the institution of other health preservation measures. A Minimum Standard for Medical Service in Industry, applicable to all industrial organizations regardless of size, was formulated following personal surveys by representatives of the College. The first list of approved medical services was

published in 1933. The 1940 list showed 937 medical services approved out of 1,787 under survey, or 52 per cent.

A manual entitled "Medical Service in Industry and Workmen's Compensation Laws" was prepared in 1934 by Dr. M. N. Newquist and revised in 1938, for the guidance of firms desiring to meet the requirements. Industry in general has welcomed the standard and the certificate of approval is displayed to show that confidence of the employes in the service is merited.

Medical service in industry, before this movement started, was a stepchild in the industrial plant, and was at the same time neglected and more or less disapproved of by its parent, medicine. Its prestige has grown as its potentialities have been recognized and the standards have been raised. Accompanying the improvement has been direct benefit to both employer and employee. Many valuable contributions are being made today by the medical departments of industrial concerns, and undoubtedly the work of the College in this field has been influential and stimulating.

FRACTURES AND OTHER TRAUMAS

A committee on fractures was appointed in 1922 with Charles L. Scudder as chairman. Its aims are best expressed in the chairman's first report:

"During the war period fractures were treated by both British and American surgeons with results hitherto deemed impossible, but there is no recognized authoritative standardization of fundamental principles governing the treatment of fractures. There are no generally recognized appropriate uniform methods of treatment."

The committee has conducted a continuous educational program among surgeons to provide better care for fractures. These efforts have done much to reduce the tremendous social and economic loss resulting from the million or more fractures which occur in the United States and Canada annually. One of the concrete aids has been the publication of an "Outline of the Treatment of Fractures," first issued in 1931, and last revised and amplified in 1940. The "Outline" enjoys an established position as the most authoritative and most widely used guide in the treatment of fractures.

That the work of this committee, now known as the Committee on Fractures and Other Traumas, is widespread, is shown by the fact that subsidiary to it are eighty-five regional fracture committees having a membership of about 1,400 surgeons. These committees carry out the various programs evolved by the fracture committee, which include using influence locally for the provision of adequate, safe transportation from the site of injury to the place of treatment, the proper equipment of ambulances, provision in the hospitals of special accommodations for the reception of emergency cases, adequate organization for the proper care of patients with fracture in hospitals and education both for the profession in the care of fractures and for the laity in the application of first aid.

GRADUATE TRAINING IN GENERAL SURGERY AND THE SURGICAL SPECIALTIES

The educational function has been dominant in the efforts of the College to elevate the standards of surgery. It has been furthered through all of its activities, beginning with the establishment of qualifications for fellowship, which must be high, but must also be attainable so that they may be enforced. Helping the prospective Fellow to gain the requisite training has always been a concern of the College, and since 1930 several committees have been appointed to study the problem. In 1937, a Committee on Graduate Training in Surgery was established to investigate, analyze and evaluate the opportunities for the training of surgeons in hospitals of the United States and Canada.

The field staff began personal surveys of a selected group of hospitals in 1937, in connection with the work of the Depart-

ment of Hospital Standardization. As a result of these surveys, information was gathered for the development of fundamental principles upon which acceptable plans of training should be based. These were elaborated in 1940 into the "Manual of Graduate Training in Surgery," prepared by Assistant Director Harold Earnheart, which contains and explains the "Minimum Standard for Graduate Training in Surgery."

The fundamental principles were applied as a basis for approval in 1938 and 1939 and a list of hospitals of the United States and Canada approved for graduate training in surgery was published first in January, 1939. The Approval Number of the Bulletin of the College in October, 1940, contained a list of 200 hospitals which met the new Minimum Standard for graduate training in surgery, and also a directory of the approved plans, including detailed description of the provisions for basic science study, supervision and the gaining of practical experience.

The program of the College is in harmony with the recommendations of the Commission on Graduate Medical Education, on which the College was represented, whose report was published in June, 1940. This report says in part:

"A vigorous approval program for residencies acts as a strong stimulus to hospitals to organize their services so that they can meet the required standards. . . . Modern transportation and the better distribution of well qualified specialists should in the relatively near future make specialized medical services available in all but the smaller communities. . . . Many hospitals have recognized that, even from the purely selfish standpoint of improving their community standing through better medical service and thus helping to fill their empty beds, they can well afford to support an educational program for interns and residents. . . . During 1938 and 1939, the American College of Surgeons published a series of reviews of hospital residency programs in surgery and the surgical specialties that met the standards of the College. While these articles describe only the surgical services, they do indicate the wide variety of good educational programs being developed by hospitals and medical schools in various parts of the country. Cost appears not to be an insurmountable obstacle to the development of good programs."

The directory that has now been published is the first presentation of selected graduate training programs that has ever been available to the graduate in medicine as a guide in his plans for qualifying himself to practice surgery. It makes possible careful selection of the institution which offers the program best suited to the individual's needs. Unquestionably, there is also a stimulation to the hospital in having its program appear in a form permitting ready comparison with the programs of other institutions.

The hospitals have co-operated enthusiastically in the program, and have acknowledged that the new "Manual" is of great aid to them. On specific problems, they consult the College, and are showing eagerness to have their graduate training programs, as one director expressed it, enable them to "take our part in providing the needed services for the training of surgeons who will be able to qualify as specialists in surgery." Many of them want to know how nonteaching hospitals can become teaching institutions, and they are told that this can be done through interest and effort of the medical staff and the existence of sufficient pathologic material and a pathologist willing to devote the time to teaching.

The College has encouraged more hospitals to assume the responsibility of training surgeons according to high standards, which include provision for basic science study on the gradual level as well as systematic supervision and other essential elements of a well rounded program requiring two and preferably three or more years of training in surgery following a year of general internship. The requirements for fellowship have recently been raised to include this amount of training.

The fullest co-operation has been extended by the College to the various

surgical specialty boards in their work of stimulating higher qualifications. All of the boards are made up of Fellows of the College. For the first board that was formed, the American Board of Ophthalmology incorporated in May, 1917, the College provided office space and secretarial aid for the first two years of its existence.

The aim of the College is to increase the opportunities for acceptable training in the moderately sized communities as well as the large medical centers, for more people live in such communities and well qualified surgeons should be better distributed than is the case today.

POSTGRADUATE EDUCATION OF THE SURGEON

The College utilizes every available means and is constantly devising new ones to further postgraduate education of the surgeon. Some of these means are, visual education through clinics and demonstrations, exhibits and medical motion pictures; verbal education through its publications and its library and department of literary research; and oral education through programs given by members of the fracture committees, for instance, at professional gatherings, and through the scientific sessions, conferences and panel discussions at the Clinical Congress and Sectional Meetings.

Clinical Congress and Sectional Meetings. A leading method of postgraduate education utilized by the College remains the surgical clinic—the "show me" idea. The 1940 Clinical Congress, with its five days of operative clinics, demonstrations, and exhibits in forty or more approved hospitals in Chicago, was the thirtieth. The clinical programs are so arranged that subjects in general surgery, orthopedic surgery, thoracic surgery, neurosurgery, cancer, fractures and other traumas, urology, obstetrics and gynecology, ophthalmology, and otorhinolaryngology are correlated to enable the surgeons to devote their time continuously to clinics dealing with the specialty in which they are most interested. Clinics are also held in connection with the Sectional Meetings, conducted each year since 1923 in three or more medical centers not large enough to accommodate the Clinical Congress, but providing sufficient clinical facilities to attract surgeons in an area ranging from six to twelve states or provinces.

As the years have passed, however, the scientific sessions, conferences and symposia have been attracting so much interest that the program has had to be extended and developed. Perhaps two reasons account for this; first, the prospective surgeon today has a longer period of training than the one of twenty years ago and sees more operative work, therefore, he has not the avid eagerness of the generation that preceded him to see surgeons perform, because he has had more opportunity to satisfy his curiosity in this respect; second, the surgical motion picture and the improved technic in graphic presentation of cases and follow-up studies have made the large operative clinic less necessary, although still important. Increasing appreciation of the importance of rigid asepsis in the operating room has also been a factor discouraging the presence of observers except in very limited numbers.

The Clinical Congresses attract three thousand or more surgeons to the large medical center in which they are held, and the Sectional Meetings often attract a thousand or more registrants.

The symposia have an especially valuable means of furthering the special activities of the College. A series of "Cancer is Curable" symposia, for example, at successive Clinical Congresses, stimulated the establishment of the archives of five-year cures and of interest in the encouragement of cancer clinics. Improved treatment of fractures and other traumas has been furthered through the usual symposia on this subject, as well as the clinics devoted to it.

Library and Department of Literary Research. The Library was organized in

1921. It comprises a collection of some 25,000 volumes including current textbooks, journal files and historical works. These reference works are supplemented by a collection in excess of 100,000 reprints. Many rare books and manuscripts have been contributed.

The Department of Literary Research consists of a staff of workers equipped to select reprints on medical and surgical subjects, compile bibliographies, prepare abstracts and make translations. Reprints are supplied without charge in package library form. Each year, many requests for literary research are received, some of them being continuous surveys which have been carried forward through the years. The charge for the research service is nominal in comparison with the service that is rendered.

Medical Motion Pictures. The study of medical motion pictures for the profession and the laity was undertaken by the College in 1926 as the value of this medium of education became recognized. Specific fundamental requirements concerned with selection of the subject matter, preparation of the scenario, ethics, illustration by animation or drawings, photography and teaching value were developed by the College for use in evaluating films. Films received are reviewed by a committee of recognized authorities on the subject matter portrayed. The committee often suggests to authors ways in which films may be improved. When they are approved, the author of the film is authorized to insert a legend showing such approval. A list of approved films is published in the Year Book and in the Approval Number of the College Bulletin. The first film approved was one by Allen B. Kanavel on "Infections of the Hand" which is still authoritative and widely shown.

Medical motion picture showings are a feature of every Clinical Congress and Sectional Meeting of the College.

Exhibits. Under Dr. Crowell's direction, the College has acquired a number of educational and scientific exhibits, assembled for the present on the ground floor of the John B. Murphy Memorial Building adjoining the College headquarters, as contributions for the future Hall of the Art and Science of Surgery. Included are the Lister exhibit presented to the College in 1927 by Sir Henry Wellcome; exhibits presented by the Cleveland Clinic on the energy system of animals; an exhibit on the treatment of burns presented by Dr. Roy D. McClure and Dr. Grover C. Penberthy of Detroit; and exhibits on cancer, fractures and traumatic surgery which have been prepared by the College. The collection is not a museum in the strict sense, but is rather a repository for instructional material of significant and current interest in the development of surgery.

Scientific and technical exhibits are a feature of every Clinical Congress. The American College of Surgeons encourages scientific exhibits but has not developed this particular phase of the meeting as have other organizations. The exhibits shown by the College have largely to do with the progress of its numerous activities and serve chiefly to acquaint the Fellows with them.

Publications. The Official Journal of the College is *Surgery, Gynecology and Obstetrics*, with the *International Abstract of Surgery*, published monthly, with an additional special issue on February 15 in which papers presented at the Clinical Congress are published. The pages of the Journal are open to all surgeons whether or not they are Fellows. A Year Book is issued every alternate year, which contains a complete list of the Fellows and a summary of the various activities; in the intervening years a supplement is published containing the names of new Fellows admitted to the College and the annual reports of the different departments and committees. A Bulletin is issued five times a year, for distribution to Fellows, hospitals, Junior Candidates and others interested; the October issue is the "Approval Number" in which appear lists of approved

hospitals, hospitals approved for graduate training in surgery, approved medical services in industry, cancer clinics and medical motion pictures. The Year Book also contains these lists.

Reprints and monographs are distributed on occasion. Outstanding among these are: the "Manual of Hospital Standardization," revised and amplified in 1940; the "Outline of the Treatment of Fractures," revised and amplified in 1940; the manual on "Medical Service in Industry and Workmen's Compensation Laws," revised in 1938; the manual on "Organization and Conduct of Cancer Clinics in General Hospitals," published in 1939; and the "Manual of Graduate Training in General Surgery and the Surgical Specialties," published in June, 1940.

PUBLIC EDUCATION

The task of educating the public to appreciate the advantages of the best possible surgical and hospital service was undertaken as a necessary accompaniment to an effort to elevate the standards of surgery. The several means employed have been: *Community Health Meetings.* A feature of every Sectional Meeting and of most of the Clinical Congresses is an evening meeting for the public at which leaders in the profession give addresses, often illustrated, on topics relating to health, scientific medicine and improved hospital service. *Motion Pictures.* The work of the College in approving medical motion picture films extends to those intended for the laity as well as those of a professional nature. *Radio.* Specially prepared talks on health and medical science are broadcast during every Clinical Congress and Sectional Meeting. *Press.* Co-operation with the press has been close. The practice at the Clinical Congress and Sectional Meetings is to appoint a committee of surgeons representing general surgery and each of the surgical specialties to form a board of consultants with whom the representatives of the press may confer concerning the highly involved scientific material that is often presented. The College also works constantly with newspapers and magazines in presenting to the public surgical and hospital news of interest. *Exhibits.* The public has a chance to view the exhibits in the headquarters hotel at the time of the Clinical Congress. Exhibits are also displayed on special occasions, for instance, at A Century of Progress Exposition in Chicago. On display at the present-time in the Museum of Science and Industry in Chicago is an exhibit which portrays some phases of the history of surgery, the history of the development of the care of the sick and injured, the organization of medical services in industry and the essential features of Hospital Standardization.

ADMINISTRATION

The College was founded largely on the administrative genius of one man, but Dr. Martin built well and selected his associates wisely and the steady progress of constructive activity was not interrupted by his passing in 1935. Associate Directors, Crowell and MacEachern, already had the confidence of the fellowship, and the years since have established them firmly as leaders who have the judgment and vision needed to carry the College forward.

The administrative staff, exclusive of the Journal, consists of about fifty-five members, housed in the attractive headquarters building presented in 1919 by lay friends and Fellows residing in Chicago. Adjoining is the Murphy Memorial Building, a gift by the family and friends of Dr. Murphy, which houses assembly halls, the library and temporary museum space. The entire College property, which includes the quarter block diagonally opposite the headquarters' building on Erie Street, is conservatively estimated at one and one-quarter million dollars.

The expense of the activities is around a quarter of a million dollars a year, including the salaries of the administrative staff. The work is supported chiefly by the fellowship through contributions to the

endowment fund and the payment of a fellowship fee and annual dues.

OFFICIAL LEADERSHIP

George Crile of Cleveland was chairman of the Board of Regents from 1924 to 1939; the present chairman is Irvin Abell of Louisville. The president for 1940–1941 is Evarts A. Graham of St. Louis. His predecessors have been:

John M. T. Finney, Baltimore	1913–1916
George Crile, Cleveland	1916–1917
William J. Mayo, Rochester	1918–1920
George E. Armstrong, Montreal	1920–1921
John B. Deaver, Philadelphia	1921–1922
Harvey Cushing, Boston	1922–1923
Albert J. Ochsner, Chicago	1923–1924
Charles H. Mayo, Rochester	1924–1925
Rudolph Matas, New Orleans	1925–1926
W. W. Chipman, Montreal	1926–1927
George D. Stewart, New York	1927–1928
Franklin H. Martin, Chicago	1928–1929
Merritte W. Ireland, Washington	1929–1930
C. Jeff Miller, New Orleans	1930–1931
Allen B. Kanavel, Chicago	1931–1932
J. Bentley Squier, New York	1932–1933
William D. Haggard, Nashville	1933–1934
Robert B. Greenough, Boston	1934–1935
Donald C. Balfour, Rochester	1935–1936
Eugene H. Pool, New York	1936–1937
Frederic A. Besley, Waukegan	1937–1938
Howard C. Naffziger, San Francisco	1938–1939
George P. Muller, Philadelphia	1939–1940

SUMMARY

The progress of surgery in America and the progress of the American College of Surgeons are synonomous because the College has set itself to discover needs and to shape its activities toward meeting them. It is not a membership organization whose primary object it is to protect and to promote the interests of its members individually. The purpose is rather to provide an avenue through which the members may submerge their individual and selfish interests and unitedly focus effort on improving their service to the patient. The active interest of the organization in the education and training of the surgeon and in improvement of the environment in which he works in hospitals and in industry, is centered not upon him personally but upon enabling him to obtain better surgical results. This larger concept completely coincides with the highest motive of the individual surgeon who has dedicated himself to service.

The formula that the College follows is almost always the same, whether great projects like the standardization of hospitals and the organization of cancer clinics, or lesser ones like the standardization of surgical dressings and the approval of surgical equipment, are involved. First comes recognition of the problem. Second comes survey to determine the actual conditions and the extent of the need. Third, the co-operation of other groups concerned is sought, and effort is made to avoid duplication of effort. Fourth, a permanent set-up is established, either as a function of an administrative department or of a committee or committees under administrative guidance. Fifth, a standard is formulated, the meeting of which will help to correct the fault or overcome the deficiency. Sixth, the need and the way in which it can be met are publicized. Seventh, surveys are made to determine who are meeting the standard, and the approval list is publicized as a spur to competition. Eighth, assistance is given in meeting the requirements. Ninth, constant resurveys are made to assure maintenance of the standard. Tenth, progressive interpretation of the standard is made to conform with scientific, technical and ideologic advancement.

Participation in the activities is possible for an exceedingly large proportion of the fellowship at any given time. There are executive, credentials and judiciary committees in every state and province, and in ninety-one different districts there are in addition committees on applicants. On the eighty-five regional fracture committees are 1,400 men. On the Board of Governors are 150 members. More than 200 Fellows are serving on the other committees, including the Committee on the Library, the Committee on Fractures and Other Trau-

mas, the Committee on the Hall of the Art and Science of Surgery, the Committee on Bone Sarcoma, the Committee on Medical Motion Pictures, the Joint Committee on Nursing Service with American Nurses Association, the Committee on Graduate Training, the Advisory Council for Ophthalmology, the Advisory Council for Otolaryngology, the Board of Regents, Executive Committee, Finance Committee and Advisory Council to the Board of Regents. Participation in the meetings is another activity that is well supported by the entire fellowship. The roster of names of speakers, leaders of discussions, and clinical demonstrators at the Clinical Congress and Sectional Meetings through the years constitutes a roll call of the outstanding American and many foreign surgeons, and the published papers furnish year by year records of progress in surgery in general and in special fields.

Looking ahead, the College faces with the rest of the nation, as it did once before, the threat of war. With the same enthusiastic response, it is rising to the needs of the national defense program. The chairman of the Board of Regents, Dr. Abell, is chairman of the committee appointed in September, 1940, to co-operate with the national defense commission of the United States on all phases of public health. Serving with him are the three Surgeons General, all Fellows of the College. The 1940–1941 president, Dr. Graham, is chairman, and Regent Alton Ochsner of New Orleans is vice chairman of the Advisory Committee on Surgery of the National Research Council, appointed in June, 1940. This committee has several subcommittees to represent the various surgical specialties and to investigate specific problems. Most of the members of the committees are Fellows of the College, so that again the organization that represents the surgical profession in action and as a whole, is in a national emergency enabling the surgeon to present a united front.

There are those now who criticize the American College of Surgeons because of its size, its inclusiveness, as once there were those who feared it would be an "oriental oligarchy," patterned after the "aristocracy of the old world." It is true that the College fellowship roll of nearly 13,000 makes it the largest surgical organization in the world. However, the aim has never been to create an exclusive organization for the purpose of giving distinction to the members, but to set the qualifications just high enough so that they can be attained with reasonable effort under existing circumstances by the competent surgeons upon whom the public throughout the country must rely and for whose competency an authoritative gauge is needed as a basis for public confidence. The aim "to elevate the standards of surgery" is interpreted as an obligation to elevate the standards of the greatest possible number of surgeons.

Succinctly, Donald C. Balfour, in his presidential address in 1935, stated the significance of the American College of Surgeons to progress of surgery in America:

"The accomplishments of the American College of Surgeons are recorded in the status attained by American surgery today."

CERTIFICATION OF SPECIALISTS BY THE AMERICAN BOARDS

PAUL TITUS, M.D.
Secretary of the American Board of Obstetrics and Gynecology and of the Advisory Board for Medical Specialties
PITTSBURGH, PENNSYLVANIA

THE organization of the American Boards for examination and certification of specialists by official groups representing thirteen separate medical specialties is essentially an educational movement. It marks a second important phase in the move to improve medical education in this country, this being related directly to graduate, as distinguished from undergraduate, medical education.

The first phase dealt with undergraduate medical education, which up to about 1900 was in a deplorable state due to the existence of "diploma mills," "night schools" of medicine, as well as poorly equipped medical schools in recognized universities, functioning and turning out doctors of medicine in direct competition and holding equal rights with graduates of the finer, properly conducted medical schools. The state licensing boards constituted the only deterrent to these poorly taught recent graduates, and on that account many such schools specialized in "quiz courses" designed for the express purpose of coaching their graduates to pass state board examinations. The universities themselves, the licensing boards, various interested philanthropic foundations, and the Council on Medical Education and Hospitals of the American Medical Association recognized the need for radical improvements and higher minimum standards of undergraduate medical education. Through their combined efforts, the extensive surveys of medical schools with their classification and formal recognition or loss of recognition by the American Medical Association and by State boards initiated at about that time (1900) that first phase which has resulted in the extraordinary elevation of undergraduate medical education in this country with which now we are all familiar.

How immensely this has been of benefit to the sick public of this country cannot possibly be estimated.

During all of this time there were specialists in various fields of medicine. Some of them were well qualified for their special practice and many were not. Training and experience in the specialties were acquired in various ways. The usual method was that of prolonged assistantships under the tutelage of some already recognized specialist, working up through dispensary services and assistant staff hospital ward appointments to direct associateships, with gradually increasing responsibilities, opportunities and clinical privileges. Internships and residencies in the various specialties were relatively uncommon, and the opportunities for what we speak of now as intensive training by the special residency system were distinctly limited in number throughout the country. Short "refresher" courses or visits to clinics in the larger centers here or abroad were considered admirable in rounding out a man's special training by the assistantship method. Longer courses and even hospital services were obtainable, chiefly on the European continent, and several postgraduate schools were established in this country in an effort partially to supply the demand for graduate medical education, but the entire situation was chaotic and entirely unregulated.

There was nothing by way of standards or formal appraisal of qualifications to gauge or establish a man's right to call himself a specialist in any branch of medicine, and even to this moment the American Medical Directory feels obliged to accept a

man's own appraisal of himself in its inclusion of symbols indicating specialization after the names in its Directory lists.

Both the lay and the medical public had little else by which to judge capability than an individual's self-appraisal and his own announcement of himself as a specialist. It is true that results counted for much and the well trained man was outstanding in his specialty, but the public is gullible and incapable of judging about such things. There was nothing to assure the public that the fundamental requirement for a claim to "specialization," namely, adequate preliminary training and unusual opportunity for clinical experience, had been fulfilled. "Fee-splitting" flourished, practices grew and some of the less qualified specialists became really competent from what they learned while practicing on the private patients who had come to them in all good faith.

As said before, however, there were many really well trained men in the specialties and others following them who sought to be as well or even better trained. Some with incomplete fundamental training were honest enough to recognize their own disadvantages and to wish to improve conditions and training facilities for their followers. The outstanding teachers and the heads of the better clinics realized the need for special internships and residencies for graduate medical education, and the establishment of such positions began to increase in number. Johns Hopkins, Harvard, Columbia, Yale, the Mayo Clinic and many, many others were setting inspiring examples in this, and more and more of the men who were their output began to fill the important posts in this country.

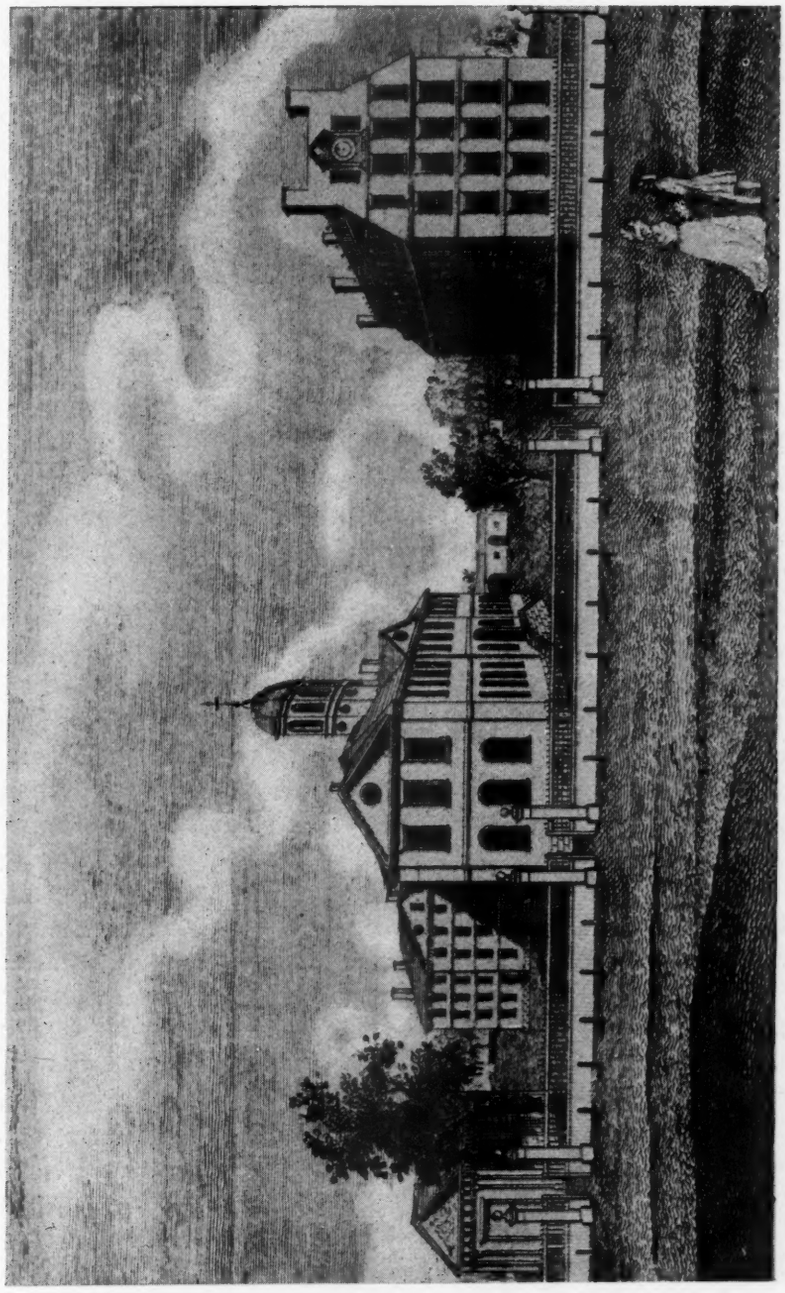
The first phase in our medical history which marked the phenomenal improvement in undergraduate medical education was leading naturally and logically to the second phase, or that related to graduate medical education. This latter demanded an improvement in graduate medical education, especially for the practice of the specialties, and some method whereby the public and the profession might be able to evaluate the qualifications of those claiming to be specialists.

In 1916, the establishment of the American Board of Ophthalmology marked the first formal step in this and was the example which inspired all of the others that were to follow. This Board, composed of outstanding and recognized ophthalmologists, undertook to formulate certain minimum training requirements and then to examine and certify as specialists in ophthalmology those who applied voluntarily to the Board for such recognition. The American Board of Otolaryngology was created along similar lines with identical objectives in 1924, was followed in 1930 by the American Board of Obstetrics and Gynecology, and in 1932 by the American Board of Dermatology and Syphilology.

Graduate medical education and training in these specialties were given a sharp stimulus by the formation and activities of these Boards, because their requirements for admission to examination were and are rigid, and their examinations severe. Certification by them was eagerly sought, and it is a tribute to the medical profession that many men so thoroughly established in their specialties that they needed no Board certification applied solely to support the movement and to set an example to their younger associates and assistants.

Men who did not have sufficient special training to meet the requirements began to demand facilities for obtaining such training; others admitted to the examinations but meeting with failure sought almost invariably by diligent effort and further study to fit themselves to pass later reexamination. Thus, it will be seen that the movement was proving to be definitely an educational one.

By 1933, these four existing Boards as well as the leaders of interested groups, such as the Association of American Medical Colleges, the American Hospital Association, the Federation of State Medical Boards of the U. S. A., and the National Board of Medical Examiners, had become



Harvard Medical School
View of the Colleges at Cambridge, Massachussetts

concerned over the threat that various informal groups without authoritative sponsorship were about to organize similar examining and certifying Boards in specialties or subspecialties which might soon nullify the effect and force of the movement because of the very fact that they lacked the proper backing or sponsorship from strong national organizations. The four original Boards, in each instance, were composed of men officially appointed by the recognized national societies in the given specialty and the related special Section of the American Medical Association.

It was clear that rules must be formulated and steps taken to establish the official and formal nature of any and all Boards subsequently to be organized. Consequently, a meeting of representatives from the four Boards and the other above named organizations was called, and from this, in 1933, a liaison organization was formed termed the Advisory Board for Medical Specialties. The major specialties were defined and named, rules and regulations for the official formation of new Boards were adopted, and election of new Boards to membership in the Advisory Board was based upon adherence to the high standards established by the first four certifying Boards. Simultaneously, the House of Delegates of the American Medical Association, through the good offices of its Council on Medical Education and Hospitals, adopted an identical set of regulations, and the Council agreed not to recognize any group as an American Board which had not been previously approved and recommended by the Advisory Board.

Since then, the American Boards of Pediatrics, Psychiatry and Neurology, Radiology, Orthopaedic Surgery, Urology, Internal Medicine, Pathology, Surgery, Neurological Surgery, with two subsidiary or affiliate (with Surgery) Boards of Anesthesiology, and Plastic Surgery, have been officially organized and have begun to function.

It is interesting to note that the educational aspect of this movement is emphasized by the fact that the two presidents of the Advisory Board, whose tenure of office covers the period from its inception to the present moment, were chosen in both instances from the representatives of the Association of American Medical Colleges serving on the Board. They were Dr. Louis B. Wilson, and subsequently, Dr. Willard C. Rappleye, the present president.

The Advisory Board for Medical Specialties, meeting annually, has come to be a forum for the exchange of ideas and views between the representatives of the several Boards and the other educational groups making up its membership. Each certifying Board is entirely autonomous, but these joint meetings of their representatives have resulted in greater unification of standards and methods of qualification and examination of candidates. This year an annual round table conference is to be initiated for general discussion of items of mutual interest, such as the effect of terms of military service on eligibility requirements, refugees and their citizenship requirements, the value of written examinations, rulings regarding ethics and similar topics.

Early in 1940, the Advisory Board published the Directory of Medical Specialists certified by the American Boards. This volume was printed and issued through the Columbia University Press of New York and nearly 6,000 copies were distributed by subscription in its first year. Libraries, hospitals, social agencies, Government agencies and bureaus, insurance companies, industrial firms, foundations and many individuals subscribed for it. This Directory contains complete information about the organization of each Board and its examination requirements, a geographic listing with biographic data including much detailed information about each Diplomate of each Board, together with a complete alphabetic list with addresses of approximately 14,000 specialists certified to January 1, 1940. Since then, or during 1940, 1,500 more have been certified, which is about the average per year, and it is planned to publish new editions of the Directory every two years.

It is of current interest that every Corps Commander of the Medical Division of the United States Army has been supplied by the War Department with one or more copies of this Directory for active use in connection with the mobilization plan initiated by the recent passage of the Selective Service Act.

To emphasize still further the contention that certification of specialists is fundamentally an educational movement, and that it has resulted in a pronounced improvement in qualification for special practice, one needs only to note its effects on young men seeking special training and on the institutions which provide the clinical facilities for such graduate medical education. More and more demands are being made by young graduates serving their interne years for places where internships and residencies in the specialties may be had. More and more institutions throughout the country are revamping their services to supply these demands. Both the men and the institutions profit by this, but most of all it is the sick public which is benefited because of a definite bettering of the standards of practice throughout the nation.

The concrete results of this demand and the effort to supply it are shown by the facts that in 1930, 278 hospitals provided a total of 1,776 residencies and fellowships in the specialties approved by the Council on Medical Education and Hospitals of the American Medical Association. At present or just ten years later there are 4,392 residencies and 726 fellowships, or a total of 5,118, in 587 hospitals of this country, according to the recent report of the Commission on Graduate Medical Education.

Surveys of the residency facilities of the country followed by approval of institutions for residency training in the specialties are no longer being carried out through the Council on Medical Education and Hospitals of the American Medical Association alone. At present, and as indicated by the latest Educational issue of The Journal of the American Medical Association, August 31, 1940, these surveys are being conducted by active cooperation between the Council and various special Boards, and approval is based on standards of graduate medical education designed to meet the requirements of the Boards for admission to their examinations. These requirements have been established by the Boards and amplified in their working details by the Commission on Graduate Medical Education of the Advisory Board.

The work of this Commission on Graduate Medical Education was sponsored, as stated above, by the Advisory Board for Medical Specialties. The Commission, under the direction of Dr. Robin C. Buerki, recently completed an extensive review of graduate medical educational facilities in this country, a report of which has been issued, and the Commission has now been dissolved. Its report is being actively studied, and its suggestions broadly adopted by many institutions engaged in this important work. It serves as an outstanding guide to institutions either establishing residency services in the specialties, or to those reorganizing these services to meet special training requirements.

Young men completing their general internships now seek rather than object to protracted periods of hospital training in the specialties amounting to several years, realizing that this is an investment well made. They not only know that they cannot qualify for Board certification as specialists without this but also have come to appreciate the value to themselves of this graduate medical training.

Certification of specialists and the effect that this has had upon graduate education in the medical specialties is rightly to be regarded, I believe, as an important phase in the medical history of this country.

The influence that such improved standards of training is already having upon the standards of the practice of medicine in this country must be obvious to every thinking person. Best of all, this movement for the general betterment of the care of the sick, like that of the improvement in undergraduate medical education, has been initiated and is being carried on entirely by the medical profession itself.

SOUTHERN SURGICAL ASSOCIATION

HISTORICAL SKETCH

HUBERT A. ROYSTER, M.D., SC.D. (HON.)
RALEIGH, NORTH CAROLINA

THE organization now known as the Southern Surgical Association had its beginning as the Alabama Surgical and Gynecological Association, launched in November, 1886, by Dr. W. E. B. Davis, of Birmingham, Alabama. At the initial conference in Birmingham on December 15, 1886, Dr. H. N. Rosser, also of Birmingham, was elected president and Dr. Davis, secretary. This Association was short-lived. It had but one regular meeting, at Birmingham, October 11 and 12, 1887. Even before that meeting plans had been laid for extending the organization and letters were sent to representative men throughout the South, inviting them to "attend the approaching meeting of the Alabama Surgical and Gynecological Association . . . with a view of forming the Southern Surgical and Gynecological Association."

The man most influential in Alabama medical circles at the time was Dr. Jerome Cochran. He opposed the organization as a State affair, on the ground that it would interfere with and disrupt the Alabama Medical Association. This discouraged Dr. Davis, who was the active spirit in the whole movement; but Cochran finally favored the enlargement of the original organization and Davis gave him credit for this accomplishment. Other able men throughout the South, eighty in number, joined enthusiastically in forming "a truly representative Southern special society." As to the title of the new organization, the famous David W. Yandell, of Louisville, "thought the union (Surgical and Gynecological) would prove rather an unsatisfactory one, as the general surgeon would not enjoy listening to a gynecologist discuss dysmenorrhea and the gynecologist would have very little interest in the treatment of a fracture of the thigh." Upon this Davis commented: "With so great a surgeon speaking disparagingly of it—and this was the first association where the surgeons and gynecologists were combined in this way—its name has anticipated what may be expected in the future. Indeed, purely gynecological Societies will prove less frequent with each recurring year." In one respect, at least, this utterance was tardily prophetic, for twenty-eight years later the name of the Association was changed by omission of "and Gynecological," although papers on that surgical specialty continued to appear and still appear on its programs, and gynecologists form a notable, if not a large, group of its membership. And who can say "nay" to the gynecologist within our ranks when the official seal of the Association, adopted at its second session, bears the vignette of the famous Kentuckian, Ephraim McDowell, the world's first ovariotomist?

On the second day of the first and only meeting of the Alabama Association, October 12, 1887, organization of the Southern Association was perfected, with Dr. W. D. Haggard, Sr., of Nashville, as president, Dr. Davis, as secretary, and Dr. J. S. Cain, of Nashville, as chairman of the Judicial Council. "The ablest men in the South, although some were absent, were elected to fill the other places on the Council and were wired for their acceptances and they promptly responded in the affirmative."

A call for the next meeting was issued and this also was held in Birmingham on December 4, 5 and 6, 1888. All those, who had been accepted and paid their dues

during the time intervening since the first meeting, were placed on the roll as Founders. There were forty-one members in attendance and more than fifty visitors; ninety members already had been enrolled. Thirty papers were read either in person or by title. The Southern Surgical and Gynecological Association was on its way.

From its inception the Association fixed itself upon broad foundations. In his presidential address at Birmingham, December 4, 1888, Dr. W. D. Haggard, Sr., set the pace when he said: "The Southern Surgical and Gynecological Association did not spring voluntarily into existence, but was the outgrowth of necessity, and is the embodiment of power. It was the work of a few energetic minds and hearts that saw its needs, and seized the opportunity to give it form and being, which was accomplished in this city . . . in September 1887, at a most auspicious moment, and under most favorable circumstances." Clearly Dr. Haggard was interpreting the future policy of the Association, as he spoke further: "So we reach out our hands and invite into our circle such men as have by their works entitled them to the distinction of being educated, talented and industrious workers in the field of scientific research." That is a high mark for any surgical organization to adopt, but it is nothing short of what the Association has endeavored to reach during the fifty-three years of its continuous existence.

In using the expression, "we reach out our hands," the elder Haggard probably had in mind the further extension of Fellowship outside the territory. Established first as a state and then as a regional organization, the Association was never intended by the Founders to remain narrowly sectional in character. They foresaw the advantage of inviting surgeons from other parts of the country to unite with surgeons in the South for the interchange of ideas and experiences, so that those of the North, East and West might become better acquainted with their Southern confreres and present the fruits of their extensive knowledge as authors and teachers; while the surgeons of the South in turn would be stimulated to record and publish their own

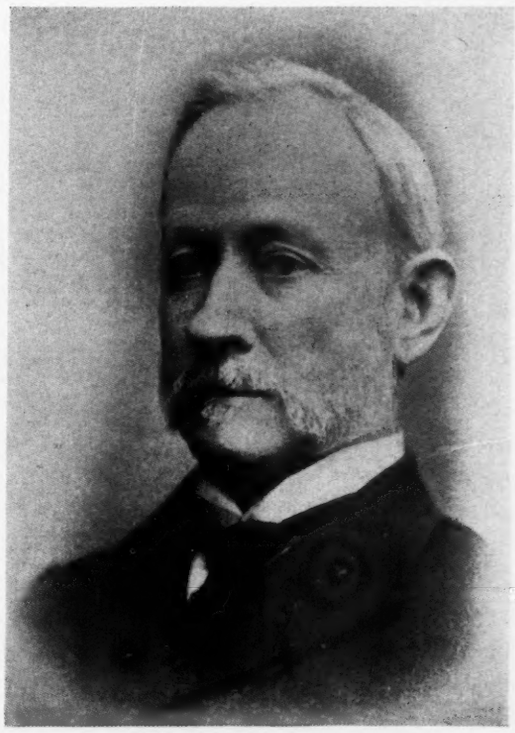


Fig. 1. William David Haggard, Sr., 1826–1901. First president of the Southern Surgical Association.

work, and show to the world their just pride in the achievements of their predecessors, such as McDowell, Sims, Battey, Nott, Dugas, Stone, Briggs, Smythe, Dudley, Eve and others, as well as those of several illustrious surgeons then living and active. Among these were Haggard, Sr., McGuire, Kollock, Brown, Gaston, Yandell, Mastin, Campbell, Westmoreland, Kinloch and Miles. The first five became presidents of the Association; the others were at or beyond the retiring age. It is notable that the celebrated Robert Battey, of Rome, Georgia, one of the country's great gynecologists, then at the zenith of his power, failed to join the Association, explaining, according to Davis, that the withholding of his name was due to the fact that "The American Gynecological Society, [of which he was a Fellow and an ex-president] looked with suspicion upon anything gynecological that was organized

at that time" and that the members of that Society "had felt the necessity of fostering their strength."

In regard to the nonsectional character of the Association and its plan of expanding the membership, Davis from the beginning insisted "that there were not enough surgeons residing in the South, of reputation and ambition to attend such meetings, who could be gotten in sufficient numbers for a successful session, except in two or three cities of the South," and he "urged the Council to invite men of great eminence from the entire country to join the Association." He further "argued that they would constitute an inspiration for the Southern men and assist in making our meetings more successful." In his presidential address (1902) he reported: "Good men in the South who had not been known before and whose reputations would not have admitted them to the national special societies, met these men from other sections of the country, and, as a result, the majority of the deserving men of the South are now members of some of the national special Societies." This statement stands true today, thirty-eight years afterward, even in greater proportion than Davis could realize.

From its birth the Association embraced the original Southern States with the inclusion of Kentucky, Maryland, the District of Columbia and Missouri. Traditionally, no Fellows without the eleven strictly Southern States and the additional ones above mentioned, has held office or participated in the management of the Association's affairs. All Fellows, wherever their residence, have complete prvileges to appear on the programs for the reading of papers, to engage in discussions and to join in the social diversions. The Association has held no meeting beyond its normal territory, except in two instances and both of these were in Cincinnati, Ohio. When Dr. Davis was elected president at Richmond, Virginia, in 1901, after a long term of service as the first secretary, it was by his request that the next session be held at Cincinnati, where he had numbers of professional friends who had joined the Association in its earliest years and had given him personal support when he needed it. It was there also that he had been elected president of the American Association of Obstetricians and Gynecologists in 1900. Again, in 1915, Cincinnati was selected as the meeting place in deference to a unanimous invitation of the older Fellows then residing in that almost Southern latitude. It is significant that in his address at the 1902 session Davis said: "We want the Association to continue to hold its meetings in the South and in Cincinnati, and we desire all the great surgeons and gynecologists of this country to join with us in the meetings." On November 15, 1903, just a month before the next meeting at White Sulphur Springs, West Virginia, Dr. Davis passed to his reward. All the last twenty-five sessions since 1915, except five, have been held at winter resort hotels. Meetings took place in Baltimore, Memphis, Louisville, Atlanta, and Lexington, Kentucky, at the urgent requests of long time Fellows who wished to renew old memories.

On its fiftieth anniversary the Association convened, December 5, 1937, in Birmingham, Alabama, the place of its origin, and during the session a wreath of flowers was placed upon the monument to Dr. Davis which adorns a public park in the city. The custom still prevails of holding the annual meetings at well known winter resorts during the off-season when the Association usually has the hotels all to itself and its guests.

The first names placed on the rolls from regions outside the South were those of W. W. Potter, of Buffalo, Abraham M. Owen, of Evansville, Indiana, William M. Polk, of New York City, and Joseph Price, of Philadelphia, all of whom were elected in 1889. The last two were Southern-born and had risen to eminence as gynecologists in their respective localities. The next year the following extraterritorial surgeons were added to the Fellowship:

Johnstone, Reamy, Reed and Edwin Ricketts of Cincinnati, and Lydston, of Chicago. From that time on leading surgeons part these members from the North, East and West attended regularly and manifested keen interest in the meetings up to

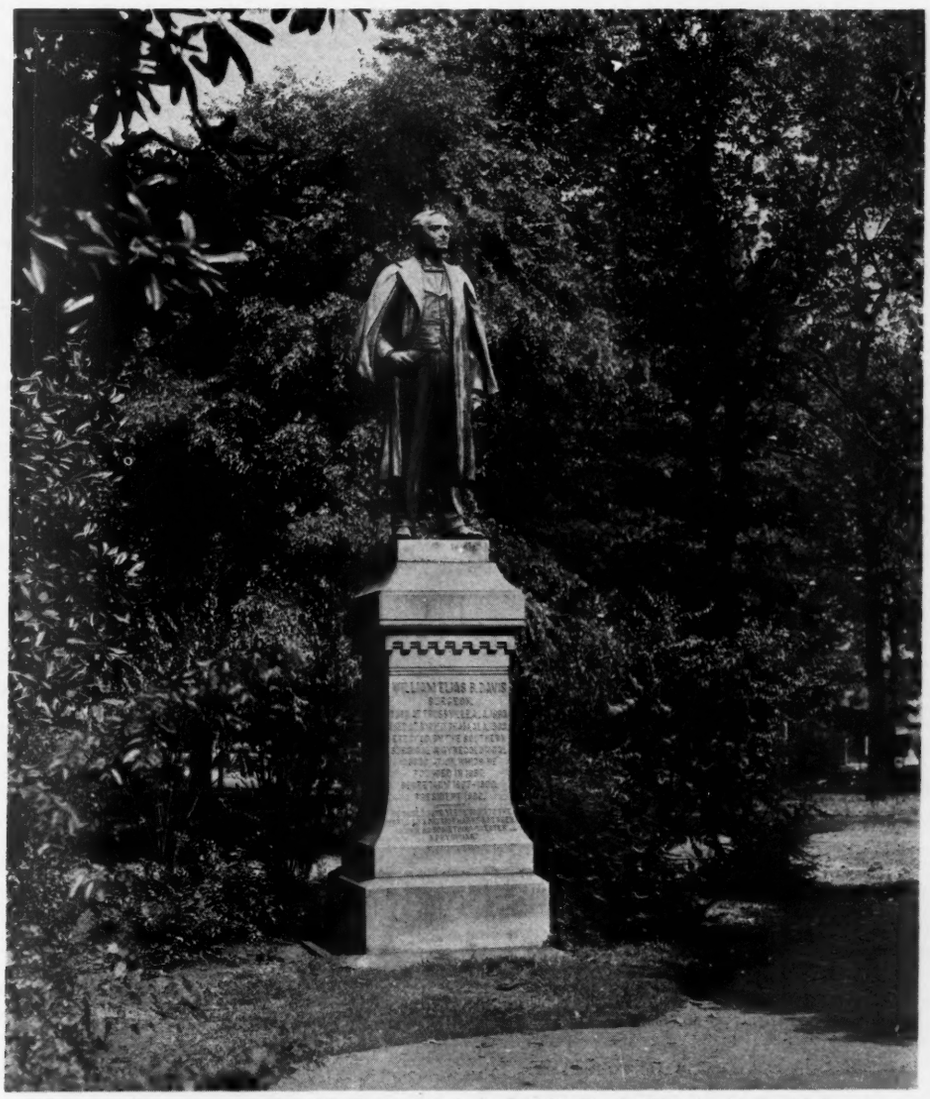


Fig. 2. Monument to Dr. W. E. B. Davis in Public Park, Birmingham, Alabama.

and gynecologists from various parts of the country were gradually elected. They were always chosen with care and due heed was given to the standing of the men. Those with Southern connections and sympathy were preferred but with no partisan prejudice, and the ratio of the membership was kept predominantly Southern.

Thus was carried out the intention of the Founders in building up and educating the younger surgeons of the South by their association with the ablest surgical teachers and clinicians in the land. For the most the time of their retirement or death. Their places were filled, and are being filled today, in the same proportion with men of distinction. During the late nineties and at the beginning of the new century, when the Association had come into its own and was recognized in this country and abroad, many of the recently acquired Fellows from without the South were presenting papers and entering into the discussions with marked activity and appetence. Such notables as Wyeth, Senn, Murphy, A. J. Ochsner, Maurice Richardson, Mixter,

R. T. Morris, Baldy, Goffe, C. H. Mayo, Deaver, Coley, Crile and many others were giving their best work of each year

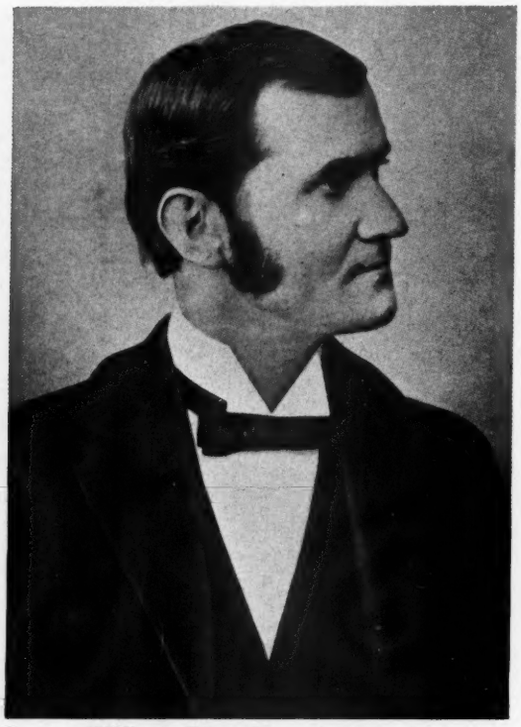


Fig. 3. William Elias Brownlee Davis, 1863–1903. Original founder, first secretary and fifteenth president of the Southern Surgical Association.

to the Association. The contributions of these men, combined with those of the distinguished surgeons in the normal Southern area, many of them teachers at the established medical schools in Baltimore, Richmond, Nashville, Atlanta, Louisville and New Orleans, furnished strong and varied programs for the annual meetings, and the Transactions of the Association soon began to present a fair cross-section of American surgery in its successive periods. As far back as 1899 Dr. A. M. Cartledge, of Louisville, in accepting the presidency, said: "Whenever I am away from home and the question of medical societies of America comes up, I hear men in the East frequently say that the best medical society in this country is the Southern Surgical and Gynecological Association . . . and we should feel a thrill of pride when some four years ago the *British Medical Journal* . . . in commenting upon our annual volume of Transactions, just published, said that they are the best we have seen emanate from America."

Dr. Davis, when he retired as secretary in 1900, spoke in similar terms: "Our Transactions are not only quoted in this country, but abroad. It has in its membership men whose writings are prized wherever medical literature is known. This means much for a section, whose medical literature amounted to almost nothing fourteen years ago." This excellent reputation of the volumes is still retained and is due, no doubt, to the composite type of its papers and the informal character of the discussions.

In the preliminary organization "no mention of limitation of membership occurred in the letters which were sent out inviting the members of the profession to join the Association." The original intention was to restrict the number to one hundred, but, to overcome any possible prejudice, the roster was left open with the hope of selecting only desirable men. In the words of Davis, "it all depended upon how much value was placed upon membership." It was not until 1891, the fourth annual session, that any limit was placed and by that time the Association had grown to such an extent that of necessity the bounds were set at one hundred fifty. When that meeting adjourned there were one hundred twenty-three members on the roll and forty-eight had been in attendance. In 1902, eleven years later, the limit of Fellowship was advanced to two hundred, and there it has remained ever since. During the session of 1888 the membership totalled ninety-seven and thirty attended. At the fifty-first meeting in December, 1938, there were on the roll two hundred Fellows, fifty-eight Senior Fellows and five Honorary Fellows. Of these there were present one hundred fifty-six Fellows, forty-five ladies and professional guests, making a total of 301, a high-water mark.

Although the number of Senior Fellows is increasing each year, the roster remains filled, because of the ever growing applications for Fellowship. During the past year there were seventy-six applicants on the list, with only nine vacancies—five by death and four by transfer to the Senior Fellowship roll. Thus is verified the ideal set by Dr. Davis when he spoke of "how much value was placed upon membership."

The Southern Surgical Association prides itself on having each year a larger attendance of the wives of its Fellows and of its visitors and on being the first Association of its kind to invite the ladies to the annual dinner. It is a hard-working body and never at any time have the social activities interfered with its professional program.

Concerning the annual program, the by-laws provided in 1888 that "the president shall appoint fifteen members, each of whom shall prepare and read an essay or lecture upon some subject of his own selection . . . made known to the Secretary, and by him to each member . . . within the first three months after the adjournment." This rule was abrogated in 1890 and thereafter the preparation of the programs was left entirely in the hands of the secretary, who notifies the Fellows well in advance of the session, asking for voluntary papers or requesting contributions on special subjects. The secretary has authority to arrange the order of papers on the program according to their titles. Since 1918 it has been necessary to confine the number of papers to a maximum of forty. This limit is always exceeded long before each meeting.

Only minor changes in the constitution and by-laws had been made up to 1917. In that year sweeping revisions were adopted. The name was shortened to Southern Surgical Association and the title of member and membership changed to Fellow and Fellowship, respectively; qualifications for Fellowship were stepped up, requiring ten years' experience in surgery or one of its specialties; and all of its surviving Founders, five in number, were added to the roster of Honorary Fellows. It was not until 1921 that a Senior Fellowship list was formed. Today this list contains sixty names, while there are only six Honorary Fellows, although as many as twenty-five are allowed.

Throughout its whole career, from the preliminary conferences up to this date, a period of nearly fifty-four years, the Association has had but five secretaries. The order of their continuity is as follows: W. Elias B. Davis, William D. Haggard, Hubert A. Royster, Robert L. Payne and Alton Ochsner. The first named served thirteen years; the second, sixteen years, the next two, nine years each, and the last named is the present incumbent, now in his sixth year of service. The secretary's term of office is five years, but all of them, Davis excepted, were elected to fill out unexpired terms and were reelected at least twice. All the former secretaries were elevated to the presidency while they were still filling their positions.

The importance of the secretary's office has been stressed throughout the history of the Association. Article VI of the constitution, as originally adopted and still in force, besides prescribing the normal duties of keeping the minutes, preserving records and registering members, charged the secretary with collecting dues, conducting correspondence and editing the Transactions. Some of these multifarious functions are performed by more than one official in similar organizations. The Southern Surgical Association gives over to its secretary the direction of its affairs, as specified above, and expects him to manage them, with the advice and consent of the Council, composed of the retiring presidents. Dr. Davis, the first secretary, regarded his post seriously, and labored untiringly and effectively until, after fifteen years he saw the Association firmly planted on solid ground, before he would agree to be released from the office and become president, a position with more honor and less work. By training the prospective secre-

taries in the traditions, the Association has continued the succession and the precedent has been warranted by the record. In the course of two more sessions, when the Association will be fifty-five years old, its five secretaries will have served an average time of eleven years each. The States represented in sequence by the secretaries are: Alabama, Tennessee, North Carolina, Virginia and Louisiana.

The fifty-three presidents of the Association in the order of their election are recorded as follows: W. D. Haggard, Hunter H. McGuire, George J. Engelmann, Lewis S. McMurtry, J. McFadden Gaston, Bedford Brown, Cornelius Kollock, Louis McLane Tiffany, Ernest S. Lewis, George Ben Johnston, Richard Douglas, Joseph Taber Johnson, A. M. Cartledge, Manning Simons, W. E. B. Davis, J. Wesley Bovée, Floyd W. McRae, Lewis C. Bosher, George H. Noble, Howard A. Kelly, F. W. Parham, Stuart McGuire, W. O. Roberts, Rudolph Matas, J. M. T. Finney, John Young Brown, John W. Long, Bacon Saunders, Thomas S. Cullen, W. D. Haggard, Jr., I. S. Stone, James E. Thompson, Willard Bartlett, Randolph Winslow, C. Jeff Miller, James F. Mitchell, LeGrand Guerry, Irvin Abell, Hubert A. Royster, Guy L. Hunner, Arthur C. Scott, Lucius E. Burch, James M. Mason, Hugh H. Trout, Robert S. Cathcart, Vilray P. Blair, Frank K. Boland, Robert L. Payne, Harvey B. Stone, Fred W. Rankin, Lloyd Noland, Albert O. Singleton and John Staige Davis.

Twenty-four of these are still living and more or less active in attendance and participation in the programs of the annual sessions. Those who have passed away represented, as do those who now survive, the cream of the surgical profession of the South, as well as the high grade of American surgery in their day.

The long and remarkably efficient services of Mr. William Whitford, official reporter of the Association for thirty-four years, deserves notice. He covered every meeting, except the first one, until his death, which occurred suddenly while he was on his way to the annual meeting. For so many years he had been reporting the proceedings of the Association that he knew every one of its Fellows, took an intimate interest in its affairs and loved its traditions. The Association honored itself by including in the 1923 Transactions a memoir of this devoted official, who in season and out, in sickness and in health, until the end came, was always at his post of duty.

Without question the leading figure of the Association during his life-time was William Elias Brownlee Davis. For many years following his death in 1903, his plans and policies were carried on by those who had been with him from the beginning; and even now his spirit pervades the organization and preserves its principles. A recital of his achievements in the early days has already been portrayed in this sketch. To Davis is due the sole merit for the conception, organization and promotion of the Southern Surgical Association, and, above, all, devotion to its purposes and ideals. He gave unstinted praise to those loyal colleagues who stood by him during the lean years; and yet, but for the encouragement, enthusiasm and energy of the dynamic Davis, the Association would not have been born nor would it have survived. Those of us who knew him will not forget his capacity for work, his genius for administration and the force of his personal magnetism, which at once attracted to himself those imbued with like motives, and as readily won over any who might differ in methods. Dr. Davis "was recognized as a surgeon of clear conception, marked conservatism and unusual skill . . . especially interesting were his various articles upon intestinal surgery." In 1892, by experiments on dogs he established the practice that transperitoneal drainage of the common duct was a safe proceeding and that, after removal of calculi, "suture of the duct was unnecessary and, indeed, harmful." This was the first observation of its kind and Dr. Davis

received full honor for it from American surgeons. Thus, the real Founder of the Association on his death at the early age of forty years, was acclaimed both a professional organizer and a scientific surgeon.

We have spoken of traditions. The Southern Association in itself is a tradition. This unique organization was conceived in the unselfish devotion and faith of the fathers and born in a righteous regard for the highest aims of surgical science. Now nearing its fifty-fourth year of existence, the Association remains true to its original ideals; not for one moment has it departed from the spirit of the principles laid down by its Founders.

What are the factors which have kept us true to our origin, that have knit us closely together and still set us apart from all other professional societies? We love to believe that it is because we are a guild whose brothers are bound in a concurring purpose to relieve suffering, to put away death, to grow in scientific grace, to add to the world's weal. We have stood always for these things, and we will stand for them to the end. We are persuaded, also, that exploitation has never entered our threshold, and that no low or selfish interest whatever has guided our thought. Can more be said? Yes, this: Paramount and pre-eminent in the very warp and woof of the Association is an inherited tradition, gathered in the souls of the Founders, gaining momentum through the decades and going on to its flower in the lives of us all. That tradition is not visible on the printed pages of the constitution and the by-laws; neither can it be discovered in rules, resolutions or reports. It exists in the minds and hearts of the Fellows, comrades in reverence for the truth. That tradition is the tie that binds us. It is honorable; it is sacred; it is immortal.

The Southern Surgical Association, sectional in name only, national in scope, world-wide in aim, joins its sister societies in a united effort to foster the high character of our profession and to uphold the supreme standards of surgery.

THE AMERICAN SURGICAL ASSOCIATION

ELLSWORTH ELIOT, JR., M.D.
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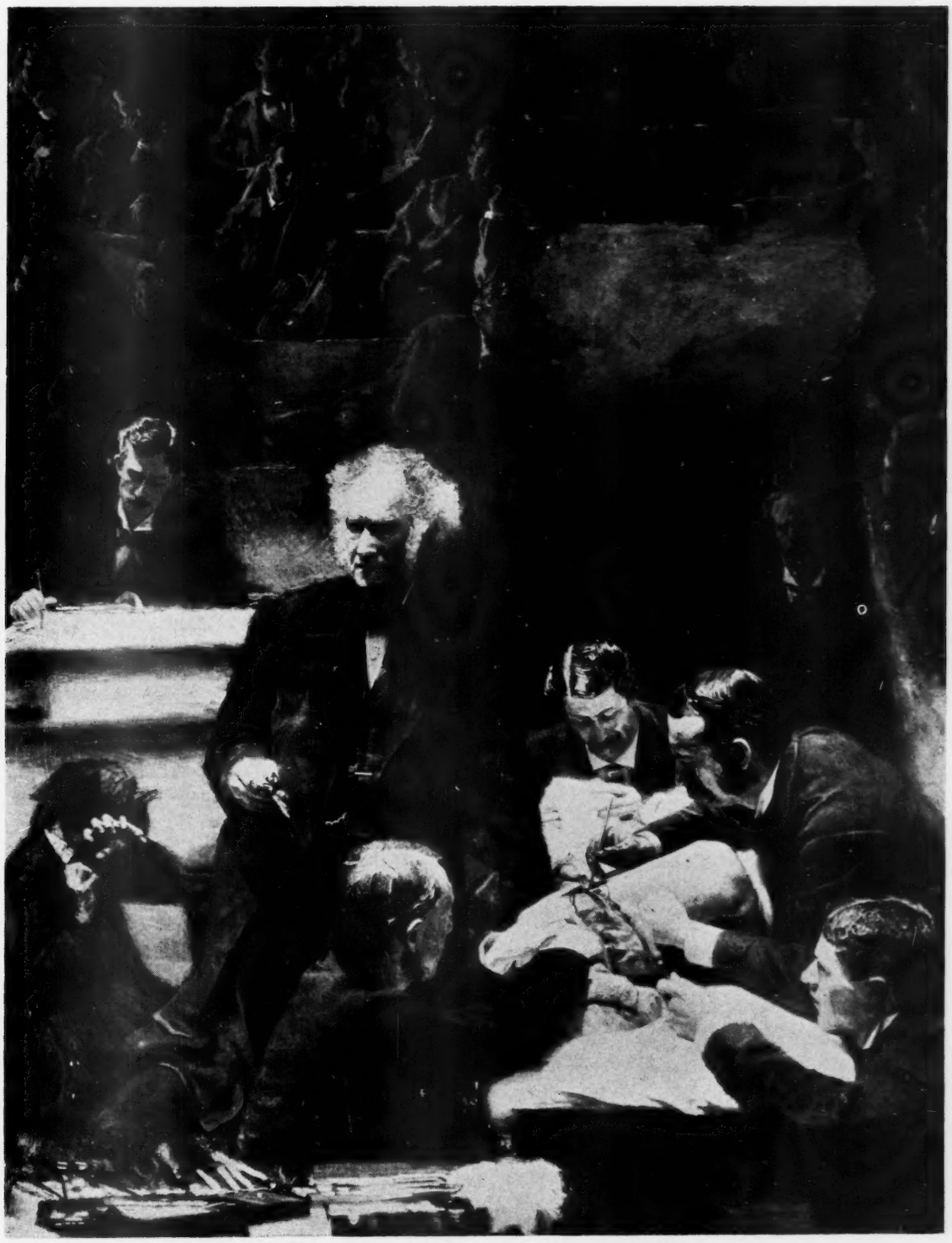
NEW YORK, NEW YORK

AT a meeting in Atlanta of the American Medical Association in 1879, Dr. S. D. Gross, of Philadelphia, in an informal conference of prominent surgeons from different parts of the country, suggested the organization of a national society which should be entirely independent of the surgical section of the American Medical Association, and which should have for its object, "The cultivation and improvement of the art and science of surgery, and the promotion not only of the interest of the Fellows, but of the medical profession at large." He again referred to this subject in his autobiography: "Its object is to foster surgical art, science, education, and literature, to cultivate good feeling in the profession, and to unite the prominent surgeons of the country in one harmonious body."

With the enthusiastic approval and coöperation of those who were approached, the American Surgical Association came into being and Dr. Gross served as its first president. In his biography Dr. Gross merely emphasizes the objects of the proposed association and does not give the slightest intimation of any dissatisfaction with the conduct of the surgical section of the American Medical Association nor of its service as an exponent of the progress of the science of surgery in this country. It is not unlikely, however, that he believed that a society, composed of a limited number of surgeons of national reputation, would prove more conducive to the stimulation of surgical advance than the necessarily cumbersome section of the national association. At all events, at the meeting in Philadelphia in 1882, he vigorously denied that the recently organized association would adversely affect the position of the American Medical Association and stated that there was ample room for both, and that in fact—a prophecy which has been fulfilled—the latter association would be distinctly strengthened. Furthermore, he added: "We hope to make the American Surgical Association an altar upon which we may annually lay our contributions to science and so show to the world that we are earnest and zealous laborers in the interest of human progress and human suffering."

It might seem that the rapid expansion which the art of surgery enjoyed as the result of the application of antisepsis, as advocated by Lister in 1867, might well account for the organization of additional societies, including the birth of the American Surgical Association to provide a more thorough consideration of surgical topics. Such an inference, however, is erroneous for the introduction of "Listerism" encountered general hesitation and scepticism both in this country and abroad. This was due in part, at least, to the failure to demonstrate actually the presence of the organisms of infection, and to the fact that Lister had merely conceived that the bacterial origin of fermentation and putrefaction, discovered by Pasteur in 1861, might readily account for wound infection. Therefore, the application of this "new-fangled" theory to the treatment of wounds had a very restricted scope for some time, and the rapid expansion of surgery for which it was ultimately responsible did not take place until some years had elapsed after the organization of the American Surgical Association.

The delay in the adoption of Listerism in this country is well shown in the discussion of an excellent paper of Watson, of Jersey City, advocating its use, which was presented in 1883 at one of the early meetings



The Gross Clinic *by Thomas Eakins (1844–1916)*

of the Association, in which surgeons of New Orleans, Mobile, Philadelphia, Chicago, Albany and New York united in stating that Listerism at that time was practiced neither by them nor by any of their colleagues. Prior to that year, at least, the prevalence of wound infection still continued to restrict the practice of surgery in this country, and surgeons of the highest reputation did not hesitate to engage in the practice of general medicine. Even Gross, in a paper published in the American Journal of Medical Science, in 1876, three years before his conception of the American Surgical Association, acknowledged that the American surgeon, as a separate and distinct class did not exist, and that "It is safe to affirm that there is not a medical man on this continent who devotes himself exclusively to the practice of surgery."

The American Surgical Association was duly organized in 1880 at a meeting in the College of Physicians and Surgeons in New York, with Lewis Sayre, president of the American Medical Association, in the chair. Officers were elected and a temporary constitution adopted. This meeting immediately followed the annual meeting of the American Medical Association, probably to insure the presence of as many as possible of those who had been invited by a committee appointed for that purpose to join in the new surgical "venture." Dr. Gross, in his autobiography, says that "The attendance was slim, not one of the prominent surgeons of New York being present."

Evidently the new Association did not meet with the approval of either Henry B. Sands or T. M. Markoe, who were then professors of surgery in the College of Physicians and Surgeons. This was even more true of Boston, for not a single surgeon of that city appears in the list of original members, though four (Cheever, Fifield, Gay and Warren) were elected to active membership in 1882. At this meeting forty-eight surgeons signed the constitution and became the original Fellows. In 1881, the meeting was held in Richmond, Virginia, again, presumably to insure a full attendance, directly after the meeting of the American Medical Association. Only nineteen Fellows were present and no papers were read.

In September of the same year (the only year in which two meetings were ever held) the third meeting, held at Coney Island, New York, was attended by eleven Fellows. Five papers were read and discussed and Dr. Gross was re-elected president for the third time. Coney Island in 1881 was very different from the popular resort of to-day, and consisted chiefly of a bathing beach and a summer hotel of frame construction with accommodations for a limited number of guests. This meeting was the first to be held without the aegis of the American Medical Association which may have accounted for the smallest attendance ever recorded; only one-fourth of the Fellows registered. In the following year, 1882, at the meeting in Philadelphia, twenty-five Fellows registered and fifty additional Fellows were elected to active membership and at the same meeting seven surgeons were elected Honorary Fellows. This included P. J. Horwitz and William Hunt, of Philadelphia, John L. Atlee, of Lancaster, Pennsylvania, and Willard Parker, Alfred C. Post, J. Marion Sims and Stephen Smith, of New York. The first foreign surgeons to be elected Honorary Fellows in 1885 were Thomas Annandale, of Edinborough, John Eric Erichson, Victor H. Horsley, Lord Joseph Lister and Sir James Paget, of London, A. S. Verneuil, of Paris, F. von Esmarch, of Keil, J. N. Nussbaum, of Munich, Richard von Volkmann, of Halle, and the noted A. C. Theodore Billroth, of Vienna. Since that year many other distinguished surgeons abroad have accepted Honorary membership, although Henry J. Bigelow, of Boston, in 1886, and two original active Fellows, Edward M. Moore and David W. Yandell in 1896, who served respectively as president of the Association in 1883 and 1889, are the only additional American surgeons to be included in the list. At this same meeting,

notwithstanding his vigorous protest, Dr. Gross was elected president for the fourth time. Four papers were read and discussed, the larger part of the meeting being occupied in the perfection of the organization. In 1883, forty Fellows registered at the meeting in Cincinnati and a number of prominent surgeons were elected to membership bringing up the number of Fellows to almost one hundred, the number originally provided for by the constitution.

As Dr. Gross steadfastly refused re-election as president, Dr. E. M. Moore, of Rochester, New York, was elected his successor. During its entire existence Dr. Gross is the sole Fellow who has served more than one term as president and after he voluntarily retired from office he was the recipient of a well deserved testimonial of appreciation, tendered unanimously by his fellow colleagues for the distinguished services he had rendered. After this meeting Volume I of the "Transactions of the Association" was published, containing all papers and discussions presented up to that time.

In 1884, at the meeting in Washington, forty-three members registered. The Association has successfully weathered its early years and has become firmly established. Membership in its ranks is eagerly, though not always successfully sought and is considered a great honor. In 1886, the Congress of American Physicians and Surgeons was organized, composed of nine National American associations, of which the American Surgical Association was one. They planned to meet once in three years in the city of Washington. The meetings of this congress are now held once in five in place of three years. This change was made shortly after the conclusion of the World War.

In 1891, a committee of twenty-six Fellows was appointed to promote the erection of a monument to Dr. Gross in the city of Washington. The efforts of this committee were ultimately successful and in 1897 a statue of Dr. Gross was unveiled in that city with appropriate ceremonies.

At the time of its organization the membership of the association was limited to one hundred active Fellows. In view of intermittent efforts to increase this membership, which both the constant growth of the country and the uninterrupted expansion of surgery seemed to justify, it is of interest to note that as early as 1883 an amendment, offered the preceding year, to increase the membership to one hundred fifty, failed to pass, on the ground that the association would thereby be rendered unwieldy. The "pressure," however, became so pronounced that in 1900 it was voted to increase the membership to one hundred twenty, and at the subsequent meeting twenty additional Fellows were elected. These included the first Fellows elected from Canada. Dr. Armstrong and Dr. Bell, of Montreal, received that honor. At the present time both Montreal and Toronto are notably represented, although no Fellow has ever been elected from Quebec.

This additional membership relieved the "pressure" only temporarily. Many desirable candidates failed of election, or were elected only after considerable delay. Vacancies occurred only through death or resignation. With few exceptions in the early years of the Association resignation was rare and was usually due to the retirement of a Fellow from active practice. In 1909, to increase the number of vacancies, those who had been active Fellows for fifteen years and had reached the age of sixty-five were entitled to become "Senior Fellows." The transactions of that year included, for the first time a list of twenty Senior Fellows and their number has steadily increased until, at the present time, there are ninety-four. The transfer of active Fellows to the senior group is now recommended by the Council of the Association without reference to either age or to the length of membership. That the urge for membership still continues, however, is reflected in the nomination of nineteen candidates at the last meeting. Since 1909 the number of active Fellows has been increased to one hundred fifty, and lately to

one hundred seventy-five. The Association has, therefore, become more "unwieldy" than was anticipated in 1883, though the interest and scientific value of the annual meeting has steadily increased.

The American Surgical Association is admittedly the premier surgical Association in the western hemisphere. To be elected a Fellow is a great honor; to fail of election is no disgrace. During its entire existence it has steadily maintained the objects which were designated by its founder, Dr. Gross. On its "altar" have been placed without reservation the most noteworthy contributions which its Fellows have made to the art and science of surgery. It has steadfastly promoted surgical education, the teaching of surgery, and what its founder never anticipated, it has been most influential in insisting upon rigid qualifications for those who wish to exchange a career as a general surgeon for one more restricted, and sometimes more conspicuous, in some surgical field. It has constantly emphasized the desirability of a training in general surgery as an essential prerequisite, and has frowned upon those who, without such qualification, would pose as surgical specialists. It exercises not only these various essential duties, but, what is of equal importance, it insists upon the maintenance of the highest ethical professional standards. It fosters friendship and intimacy and has admirably fulfilled the expectations of its founder in promoting the mutual interests of its members. Long may it survive and continue to carry forward the torch of progress of the art and science of surgery!

Man of the Year 1940. Dr. Fred H. Albee has been selected as the Man of the Year 1940 by the Greek Fraternity Kappa Sigma. Dr. Albee received this award at a Founder's Day Banquet held at the Carlton Hotel, Washington, D. C., on December 10, 1940.

THE AMERICAN GYNECOLOGICAL SOCIETY

GEORGE W. KOSMAK, M.D.
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NEW YORK, NEW YORK

ON June 3, 1876, a group of men from various parts of the United States gathered in the building of the New York Academy of Medicine in response to a summons for the founding of an organization for the advancement of obstetrics and gynecology in this country. The three men primarily responsible for the movement were Paul F. Munde, of New York, J. Tabor Johnson, of Washington, and James R. Chadwick, of Boston. At this first meeting a committee was appointed to draw up a constitution and by-laws and another committee to propose a list of officers, who were unanimously elected. These were Dr. Fordyce Barker, the first president, Dr. Atlee and Dr. Byford, vice-presidents, Dr. Chadwick secretary, and Dr. Munde, treasurer. The original Fellows numbered thirty-nine and the first annual meeting was held in New York, September 13 to 15, 1876. The celebration of the centennial of the Nation's founding was deemed an appropriate time to recognize the claim to pre-eminence which America could make with justice in this particular department of medicine. It was decided to maintain a restricted membership and require high qualifications of its candidates for admission, both personal and scientific, so that "the fellowship would be coveted and the discussions be more profitable."

The two topics which were voted as suitable for special consideration at this first annual meeting were: Incision of the cervix uteri and the after-treatment of ovariotomy. A Volume of Transactions was provided for and Dr. Billings, of the Surgeon General's Library in Washington, was commissioned to obtain for each volume a complete index for the twelve preceding months. These Transaction volumes present a very full record of the development of American obstetrics and gynecology from 1876 to the present time, and show the extensive participation of the Society's Fellows in the great work of making the combined specialty an integral part of American medical achievement. We find as contributors to the programs of the annual meetings the names of many who have attained fame, men whose names should be familiar to all students of medicine. Some of these names have survived in the appellations given to various operative procedures, diagnostic methods, instruments and, though many have been forgotten in the passage of the years, their cumulative labors have contributed to place American gynecology and obstetrics on the high plane which it now occupies.

The American Gynecological Society probably was the first national organization of its kind either here or abroad. Perhaps the only groups which antedate it are the Boston Obstetrical Society, founded in 1861, the New York Obstetrical Society, 1863, and the Philadelphia Society, 1868. Included in its Fellowship, both active and honorary, have been the leading men of our specialty both here and abroad. Among the latter have been the invited guests from foreign countries whose contacts with their American confreres have done much to cement the bonds of mutual interest and friendship which are so essential to the progress of the liberal sciences, including medicine.

Within the limit and scope of this brief presentation it is not practical or feasible to detail the work of the Society or its Fellows. All of this is fully recorded in its accumulated transactions which have been published uninterruptedly for the entire period of its existence both in special

volumes issued by the Society and in the pages of the American Journal of Obstetrics and Gynecology. These Transactions constitute an enviable record and their perusal would well repay the attention of American physicians and medical students. They demonstrate very conclusively the time, thought, devotion and labor which have been contributed to the advance of obstetrics and gynecology by the workers in this important specialty of medicine. "The latter is no longer that narrow art practised by its devotees with knowledge gained by hearsay, surrounding itself with a mantle of secrecy and holding itself aloof from the world at large."

Medicine today has entered intimately into the life around us; in fact, it is a part of the same. While still essentially individualistic, medical practice today has a widespread social and community interest, and national organizations of specialists in particular have a responsibility aside from their immediate sphere of activity which, fortunately, they have recognized and stimulated. The American Gynecological Society through its Fellows has participated actively in this development and has served as a stimulus to the formation of other similar organizations throughout the country which have elevated the appreciation and importance of our specialty.

The Society has kept pace with the development of medical art and science in the United States and has afforded opportunity for the presentation of clinical and research problems through an uninterrupted series of annual meetings, the programs of which constitute an enviable record in the progress of American medicine.

Book Reviews

EXPECTANT MOTHERHOOD. By Nicholson J. Eastman, M.D. Boston, 1940. Little, Brown and Company. Price $1.25.

It frequently happens that a prospective mother has no end of questions which she asks her physician. Some of them are relevant and many seem trivial but every one of them demands an answer. Often the time consumed in meeting these demands takes a lot of the physician's time. Therefore, although several such short books have been published during the last quarter century, this modern, sanely and beautifully written book fills the bill in every detail. It tells the expectant mother (not to mention her husband) everything one could want to know concerning all the whys and wherefores of the pregnant state. Many physicians are sure to recommend it to their patients, and in our opinion it is the best book at hand on this topic. That it is authentic goes without saying, as the author is Professor of Obstetrics at Johns Hopkins University.

ATLAS OF CARDIOROENTGENOLOGY. By Hugo Roesler, M.D., F.A.C.P. Springfield, Ill., 1940. Charles C. Thomas. Price $8.50.

This atlas is a case-history type of presentation, with the case protocols and a short comment making up the only text. While the atlas is primarily one of roentgenology, it is intended more for the clinician than the radiologist, and presents a fine correlation of clinical, laboratory, radiographic and pathologic findings. The illustrations are excellent and are by no means confined to radiographs. The plates of pathological specimens are particularly abundant, and Dr. Roesler's method of demonstrating the cardiac pathology by longitudinal and window sections is of special interest. The book should be instructive to both the student and the cardiologist.

A TEXTBOOK OF SURGERY. By John Homans, M.D. Compiled from Lectures and Other Writings of These Members of The Surgical Department of The Harvard Medical School (twenty-three authors are named). Springfield, 1940. Charles C. Thomas. Price $8.00.

Any one, surgeon or medical student, who wishes a "good" work on surgery, either for reference or textbook, will go far afield to find one that measures up to this book. It is nine years (1931) since the first edition appeared, and during that time Dr. Homans and his co-authors have kept their work in the front rank of surgical textbooks.

It is unnecessary to go into details. Suffice it to say that basically the work is authentic and fulfills in every detail the requirements of a book of this type. The authors have also kept it up-to-date. Dr. Homans in his Preface to the Fifth Edition explains how Harvey Cushing fathered the method of keeping a book alive. This book, containing 1272 pages, 530 illustrations by Willard C. Shepard, and a special bibliographical index, is worth a score of the usual run-of-the-mill surgical works usually written to complete a publisher's lists.

SHOCK: BLOOD STUDIES AS A GUIDE TO THERAPY. By John Scudder, M.D. Philadelphia, 1940. J. B. Lippincott Company. Price $5.50.

Surgeons, especially, should read, reread and digest the contents of this volume. It deals with "the importance of the chemical approach to certain of the fundamental biological problems encountered daily in our Surgical Service" (Allen O. Whipple in the Foreword). Dr. Whipple further states that it gives him great pleasure "to acknowledge the beneficial results of our surgical patients before and after operation because of his [Scudder] studies. These have developed methods and a critique which have been of the greatest therapeutic value to the Surgical Department of the Presbyterian Hospital." The work is divided into four Parts. Part One deals with the historical and experimental; Part Two with varieties of shock—their analysis and treatment; Part Three with historical development and bibliography; and

Part Four with a laboratory manual. Every section is valuable but the student with a basic background in this work will find Parts Two and Three especially interesting, while the hospital surgical chief will put his juniors to the task of becoming familiar with the facts contained in Part Four. Inasmuch as every surgeon has patients who suffer from shock, notwithstanding the apparently endless list of books and articles that have been written on this subject, we would urge that this work be acquired and thoroughly studied.

FRACTURES AND OTHER BONE AND JOINT INJURIES. By R. Watson-Jones, F.R.C.S. Baltimore, 1940. The Williams and Wilkins Company. Price $13.50.

This is several books in one, . . . a book for the fracture specialist, general surgeon and practitioner who must meet emergencies and handle fractures and other bone injuries. It is hard to review in as much as there is nothing to criticize. It is not our place to quibble over minor problems of technique. In every detail *Fractures and Other Bone and Joint Injuries* is, one might say, "the last word on the subject." The work covers the material in detail and is very well written. We would draw special attention to the illustrations, some of which are in color, the work of Douglas Kid. They are far above the average. Anyone desiring a book on fractures and bone injuries would not be disappointed should he add this one to his library.

NEOPLASTIC DISEASES. A TREATISE ON TUMORS. By James Ewing. Fourth Edition. Revised and Enlarged. With 581 Illustrations. Philadelphia, 1940. W. B. Saunders Company.

What can a reviewer say of Dr. Ewing's work, now in its fourth edition, completely revised and enlarged, other than that it is one of the best if not the very best book in its field. This reviewer believes nothing finer has been written in the English language on neoplastic diseases. The first edition appeared in 1919, and other editions were brought out in 1922 and 1928. During the past decade we witnessed additions in many branches of neoplastic disease, and the author, being abreast of all new knowledge on the subject, has virtually redone his book. It is up to the minute and that it is scientifically the last word, goes without saying. A library would be incomplete without this valuable work on its shelves.

CLINICAL UROLOGY. By Oswald Swinney Lowsley and Thomas Joseph Kirwin. Two Volumes. Baltimore, 1940. The Williams & Wilkins Company. Price $10.00.

The authors have written a readable, scientifically sound and worth while book in two volumes. It was written for all physicians, the medical student, the general practitioner, the general surgeon, not to mention its scope as a reference work for the trained urologist. The subject is covered most satisfactorily. There is to be nothing gained by going into detail. Suffice it to say that any physician, specialist, or practitioner, who requires a work on Clinical Urology, will have his every desire fulfilled with this work.

We also noted the size of the books are such that they feel good in the hands, the print is clear and large enough to make reading easy, and the illustrations by William P. Didusch are superb. Some of them are in color.

We congratulate the authors and the publishers in giving the profession such an interesting and scientifically sound set of books on Clinical Urology. It is an important contribution to the literature of this subject.

THE HEAD AND NECK IN ROENTGEN DIAGNOSIS. By Henry K. Pancoast, M.D., Eugene P. Pendergrass, M.D. and J. Parsons Schaeffer, M.D. Springfield, Ill., 1940, Charles C. Thomas. Price $12.50.

This is a large book consisting of 976 pages. There are 1,251 illustrations, some of which are in color. These illustrations are clear and are necessary to the text. The paper used is of a high grade; therefore, anyone who knows the barest fundamentals of publishing will realize that the cost is modest under the circumstances. But more important, this work is beyond value to the roentgenologist, surgeon, neurologist, neurosurgeon, otolaryngologist, ophthalmologist, endoscopist and many others who dwell in circumscribed fields of medicine. The work is a complete correlation and integration of anatomical, physiological, pathological, clinical and roentgenological observations. It is beautifully prepared and a book which we earnestly recommend.

Mallinckrodt Chemical Works

SOMEONE has said, "Fifty years in business is a rare and priceless heritage." How much more to be cherished then, is a record of more than seventy years of service to industry and mankind. The Mallinckrodt Chemical Works of today stands as a monument to the vision of three brothers, Edward, Gustavus and Otto, who in the fall of 1867, founded the chemical manufacturing plant of G. Mallinckrodt and Company, to engage in the production of fine chemicals.

The first plant was erected under Edward's supervision. It consisted of a stone structure one story in height. Attached were two wooden sheds which were used for various purposes. In addition to the main building, there was a stone acid house and another wooden shed in which aqua ammonia was made.

Mallinckrodt was one of the first manufacturers of bromides in the United States. In 1873, two distilling plants were set up along the Ohio River and bromine was recovered from the brines. The manufacture of iodides was also begun during this period, and to this day Mallinckrodt has retained its position as one of the most important producers of these valuable compounds. The introduction of burnt alum for use in the baking powder trade in 1875 was the company's first large scale venture into the industrial branch of the fine chemical field.

The company was incorporated in 1882 as Mallinckrodt Chemical Works, the name it has retained ever since. One year later, Mallinckrodt began the manufacture of photographic chemicals, a field in which it has played a major role ever since.

The decade of the Nineties saw several important additions to the Mallinckrodt line. The manufacture of hydrogen peroxide, the narcotics and the nutgall products, gallic, pyrogallic, and tannic acids, all of them items of major importance today, was instituted during this period.

During 1900 to 1910, Mallinckrodt pioneered a new field. Long an important manufacturer of ether, the company devoted a large part of its resources to the development of the best possible ether.

In 1908, the manufacture of zinc stearate was started at the St. Louis plant. This proved to be the forerunner of the complete line of stearates which the company has developed since. Nineteen hundred thirteen, marked the beginning of another important process, that for barium sulfate for x-ray diagnosis.

For many years Mallinckrodt had manufactured chemicals of a purity suitable for reagent use. It was not until 1922, however, with the establishment of the analytical reagent line that the company entered this field of operation. In 1923, other stearates were added to the line to supplement the zinc compound previously mentioned. Of these, aluminum stearate is probably the most important.

The decade of the thirties saw more new products added to the line, cyclopropane, a valuable agent for anesthesia, mandelic acid and sulfanilamide among others.

Today, the little one story plant with its four employees has grown into a far-flung business with more than one hundred factory and office buildings located in nine cities in the United States and Canada. The staff of four has become an efficient organization of over fifteen hundred employees. From a few simple materials its price list now embraces more than 2,000 items. Once a newcomer, Mallinckrodt stands today as one of America's oldest chemical manufacturers. "Seventy years and more in business is truly a rare and priceless heritage."

Merck & Co. Inc.

THE history of Merck & Co. Inc., Manufacturing Chemists, goes back almost to the very beginning of chemistry itself, for it was in 1668 that Friedrich Jacob Merck became the owner of an ancient pharmacy, "At the Sign of the Angel," in Darmstadt, Germany, and engaged in chemical investigations. In that pharmacy the manufacture of alkaloids was started in 1816, culminating in the first commercial production of morphine in 1827, and of cocaine in 1862.

In 1891, George Merck established the American house of Merck & Co. in New York City. Manufacturing operations began shortly thereafter in a factory erected at Rahway, N. J., on the property which is now occupied by the main plant, research laboratories and general offices of the Company. George Merck continued as the active, directing head of Merck & Co. until 1925, when he was succeeded by his son, George W. Merck, as president.

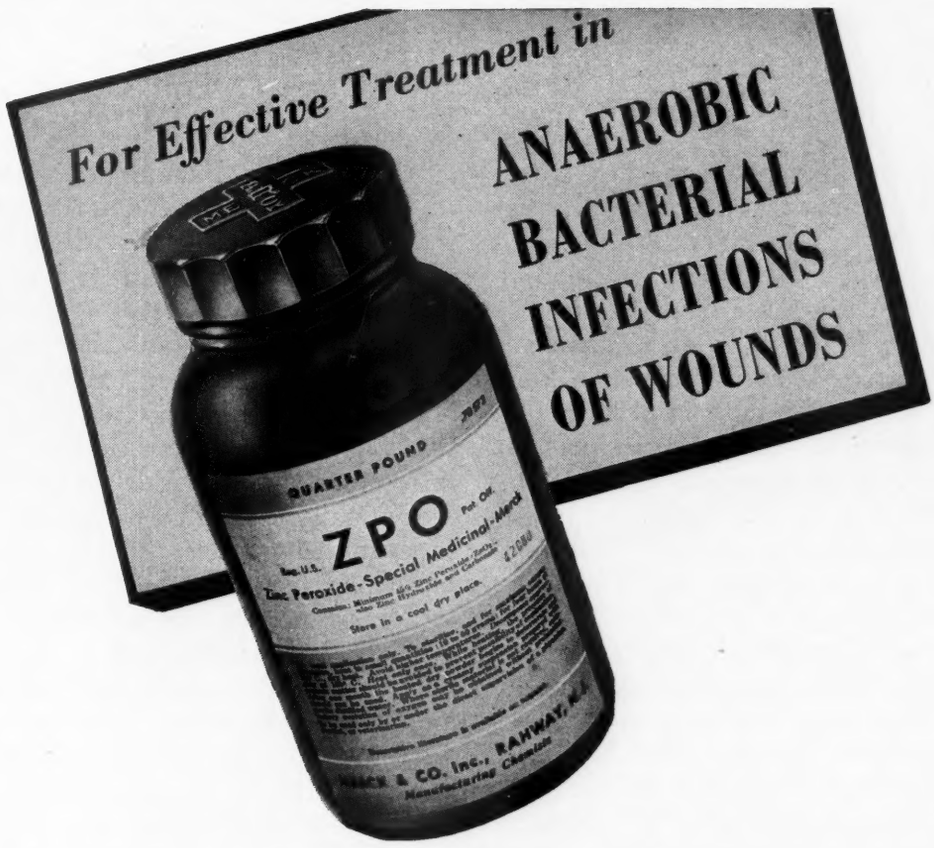
In 1927, Merck & Co., of Rahway, N. J., and Powers-Weightman-Rosengarten Co., of Philadelphia, Pennsylvania, were merged to form the organization of Merck & Co. Inc. The Powers-Weightman-Rosengarten Co. was an outgrowth of previous mergers, dating back to the partnership of Farr and Kunzi, in Philadelphia, which was formed in 1818, and to the partnership of Zeitler and Seitler, organized in 1822. Thus came into effect the combined organization of Merck & Co. Inc., with George W. Merck as president, and Frederic Rosengarten as chairman of the Board.

Today, Merck & Co. Inc. has manufacturing plants in Rahway and Philadelphia, and branches in New York and St. Louis. More than 1,800 employees are engaged in supplying almost 3,000 chemicals and drugs in various forms to physicians, pharmacists, chemists, dentists and veterinarians; to pharmaceutical, proprietary, cosmetic and industrial manufacturers, and to the general public. A similar business is conducted in Canada by Merck & Co. Limited.

Merck & Co. Inc. is a New Jersey corporation. It is owned by approximately 1,500 stockholders, most of whom reside in the United States. In fact, less than one-half of one per cent of the stock is held outside of this country and most of the foreign holdings are in Canada. In its corporate operations, the Company is entirely free and separate from any other organization, either in this country or abroad. The management of the Company is directed by a board of nine directors who are elected by the stockholders. The directors are responsible to the stockholders for the proper management of the Company, and they elect the officers who are responsible for the proper conduct of the business.

The Rahway plant consists of more than seventy buildings, containing over 700,000 square feet of floor space, and occupying approximately fifty acres, of which thirty are in Rahway and twenty are in Linden. The total estate owned in Rahway and Linden is some 160 acres. It is on these premises that the greater part of all manufacturing and packaging operations is performed. Here, too, is located the Administration Building, occupied in June, 1936, as well as the research and control laboratories of the Company.

The Merck policies of scienific research and rigid laboratory control for purity and standards of quality and uniformity—fortified by a rich tradition of experience and modern production facilities—assure continued leadership in present fields of chemistry, as well as in those still to be explored and conquered.



ZPO, a superior medicinal grade of zinc peroxide, is a distinctive preparation developed particularly to meet the special requirements for use in certain anaerobic wound infections.

It has been employed with striking success in the treatment of various surgical infections due to micro-aerophilic and strictly anaerobic bacteria.

Clinical results indicate that it is especially effective in:

- *Chronic, Undermining, Burrowing Ulcers*
- *Chronic Abdominal Sinuses; Fecal Fistulas and Superficial Ulcers*
- *Lung Abscesses and ensuing Chronic Empyema*
- *Anaerobic Infections of Dental Origin in the Face or Neck*
- *Human Bites*
- *Gunshot Wounds*
- *Prophylaxis of Accidental or Operative Wounds*

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Zinc Peroxide • Special Medicinal • Merck is supplied in
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For the Prophylaxis and Treatment of Anaerobic Surgical Infections

MERCK & CO. Inc. *Manufacturing Chemists* **RAHWAY, N. J.**

Bard-Parker Company, Inc.

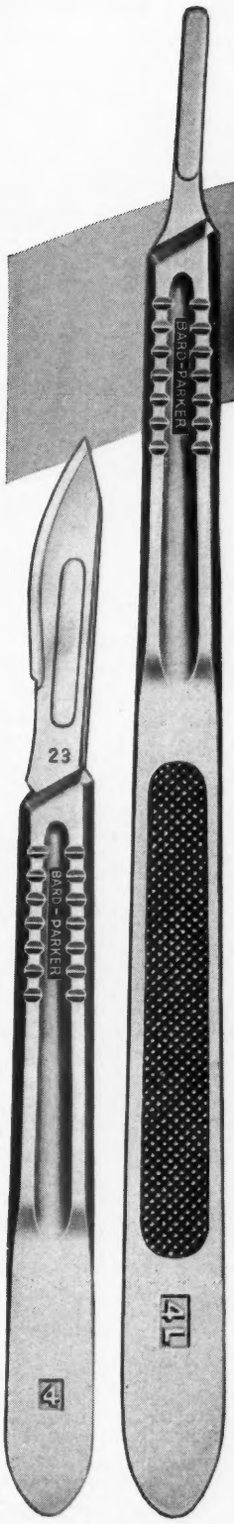
TWENTY-FIVE years ago the Bard-Parker Company, which is this year celebrating its Silver Anniversary, made its first contribution to modern surgery—the detachable blade knife. The aggravating problem of resharpening was thus eliminated. The Bard-Parker knife proved so superior in cutting performance and economy to the one-piece scalpel that it has since been generally adopted by surgeons throughout the world.

As continued improvements in manufacturing processes resulted in sharper blades, the problem of protecting the keen edges during the sterilizing process became more acute. Heat in any form was highly destructive to these edges. In 1930, Bard-Parker was able to announce its newly perfected Formaldehyde Germicide. This chemical solution provided noncorrosive and nonrusting protection to delicate cutting instruments during the preoperative preparation.

During 1932 Bard-Parker perfected its new and exclusive method of small steel form-rolling which enabled it to apply the detachable blade principle to surgical scissors. These renewable edge scissors, another outstanding advance in surgical instrument design, eliminated costly scissor regrinding and replacements in the surgical armamentarium. Further advances in steel rolling methods culminated during 1935 in the introduction of the Rib-Back blade which has since supplanted the less rigid flat blade.

The year, 1938, saw the introduction of the Bard-Parker Hematological Case for obtaining bedside blood samples for red, white and differential counts. The case introduced the first retested pipettes with individually etched correction factors contributing to greater and more rapid interpretative accuracy. During 1939, Bard-Parker presented the Ortholator to the profession. This precision device was the first to assure mathematical accuracy of angulation in dental radiologic technic. And now, in 1941, the Bard-Parker Company celebrates its silver anniversary of service to the profession by introducing the first sterile transfer forceps unit designed to protect the unbroken chain of sterility in the operating room.

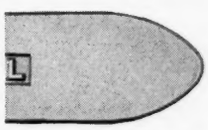
The company is justly proud of the part it has played in meeting the requirements of advancing surgical technics during the past quarter century, and it looks forward to greater achievements and opportunities to serve the profession in the years to come.



Two important innovations

in BARD-PARKER Surgical Knife Handles

. . . afford greater surgical latitude



DISTAL ENDS . . . redesigned for use in *Blunt Dissection*

Widely preferred B-P Knives now serve a dual surgical purpose. Aside from their acknowledged superiority as cutting instruments, the distal ends of the Handles are now scientifically tapered and beveled to a Gothic Arch pattern to accommodate equal pressure in blunt dissection.

By a deft movement of the fingers, the surgeon has at his immediate command the equivalent of two vital instruments which may be used alternately with greater speed and without the distraction and time-consuming inconvenience of having to exchange instruments continuously.

ELONGATED HANDLES . . . are now available for *Deep Surgery*

These new, practical Handles are 8⅜" in overall length, exclusive of detachable Rib-Back Blade. They are designated as Handles Nos. 3L and 4L, and take the same style blades as do the corresponding standard size B-P Handles Nos. 3 and 4.

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Society Meetings

AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS
New Orleans, January 12–16, 1941. (Secretary—DR. CARL BADGLEY, University Hospital, Ann Arbor, Mich.)

AMERICAN ASSOCIATION FOR THE STUDY OF GOITER
(Secretary— DR. W. BLAIR MOSSER, Kane, Penna.)

AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA
Seigniory Club, Montreal, Que., May 29–31, 1941. (Secretary—DR. RALPH G. CAROTHERS, 409 Broadway, Cincinnati)

AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS
Hot Springs, Va., May 29–31, 1941. (Secretary—DR. CHARLES C. HIGGINS, 2020 East 93rd Street, Cleveland)

AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS
Pittsburgh, May 5–9, 1941. (Secretary—MR. ARMOUR G. PARK, 540 N. Michigan Ave., Chicago)

AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLOGISTS AND ABDOMINAL SURGEONS
Hot Springs, Va., September 11–13, 1941. (Secretary—DR. JAMES R. BLOSS, 418—11th St., Huntington, W. Va.)

AMERICAN ASSOCIATION OF RAILWAY SURGEONS
Chicago, September 8–10, 1941. (Secretary—DR. R. B. KEPNER, 547 W. Jackson Blvd., Chicago)

AMERICAN COLLEGE OF SURGEONS
(Secretary—DR. FREDERIC A. BESLEY, 215 N. Sheridan Rd., Waukegan, Ill.)

AMERICAN CONGRESS OF PHYSICAL THERAPY
Washington, D. C., September 1–5, 1941. (Secretary—DR. RICHARD KOVACS, 2 East 88th Street, New York)

AMERICAN GYNECOLOGICAL SOCIETY
Colorado Springs, May 26–28, 1941. (Secretary—DR. RICHARD W. TELINDE, Johns Hopkins Hospital, Baltimore)

AMERICAN MEDICAL ASSOCIATION
Cleveland, June 2–6, 1941. (Secretary—DR. OLIN WEST, 535 N. Dearborn Street, Chicago)

AMERICAN ORTHOPAEDIC ASSOCIATION
Toronto, Can., 1941. (Secretary—DR. C. W. PEABODY, 474 Fisher Bldg., Detroit)

AMERICAN PROCTOLOGIC SOCIETY
(Secretary—DR. CURTICE ROSSER, 710 Medical Arts Bldg., Dallas)

THE AMERICAN SOCIETY OF ANESTHETISTS, INC.
New York, February 13, 1941. (Secretary—DR. PAUL M. WOOD, 745 Fifth Avenue, New York)

AMERICAN SURGICAL ASSOCIATION
White Sulphur Springs, W. Va., April 28–30, 1941. (Secretary—DR. CHARLES G. MIXTER, 319 Longwood Avenue, Boston)

ASSOCIATION OF MILITARY SURGEONS OF THE U. S.
Louisville, Ky., 1941 (Secretary—COL. JAMES M. PHALEN, 1870 Wyoming Ave., N.W., Washington, D. C.)

CONGRESS OF ANESTHETISTS
(Secretary—DR. E. KLAUS, 1699 W. 25th Street, Cleveland)

INTERNATIONAL COLLEGE OF SURGEONS
Mexico City, August 10–14, 1941. (Secretary—DR. CHARLES H. ARNOLD, 903–15 Terminal Bldg., Lincoln, Nebr.)

INTER-STATE POST-GRADUATE MEDICAL ASSOCIATION OF NORTH AMERICA
Minneapolis, October 13–17, 1941. (Secretary—DR. TOM B. THROCKMORTON, 406 Sixth Avenue, Des Moines)

NEW ENGLAND SURGICAL SOCIETY
September, 1941. (Secretary—DR. JOHN F. GILE, Hanover, New Hampshire)

PACIFIC COAST SOCIETY OF OBSTETRICS AND GYNECOLOGY
(Secretary—DR. W. B. THOMPSON, 6253 Hollywood Blvd., Los Angeles)

PACIFIC COAST SURGICAL ASSOCIATION
Los Angeles, February 19–22, 1941. (Secretary—DR. H. GLENN BELL, University of California Hospital, San Francisco)

PAN-PACIFIC SURGICAL ASSOCIATION
Honolulu, 1942. (Secretary—DR. FORREST J. PINKERTON, Young Bldg., Honolulu)

SOUTHEASTERN SURGICAL CONGRESS
Richmond, Va., March 10–12, 1941. (Secretary—DR. B. T. BEASLEY, 701 Hurt Bldg., Atlanta)

SOUTHERN SURGICAL ASSOCIATION
(Secretary—DR. ALTON OCHSNER, 1430 Tulane Avenue, New Orleans)

WESTERN SURGICAL ASSOCIATION
St. Paul, Minn., December, 1941. (Secretary—DR. ARTHUR METZ, 2449 Washington Blvd., Chicago)

The Massillon Rubber Company

THE Massillon Rubber Company was organized January 11, 1913, to produce surgeons' gloves with Mr. J. G. Lester president and general manager. Many well known firms in the surgical field helped us with the introduction of Massillon gloves at that time and are still handling our products. Among them are Doster-Northington, Todd-Gaynor (now Gaynor-Bagstad), Jamison Semple Company, E. F. Mahady Company, E. A. Merkel Company, Paine Drug Company, Reid Bros, P. L. Rider Company, Schuemann-Jones Company, Spokane Surgical Supply, Surgical Selling and Max Wocher & Son Company.

The Company expanded in 1924 and, again in 1930 when they introduced the first surgeons glove manufactured directly from liquid latex under a license agreement with American Anode. The firm has consistently confined its effort to the manufacture of surgical gloves and surgical tubing and ever since the organization of the Company, it has enjoyed an enviable reputation for quality merchandise among the surgeons and hospitals of this country and abroad.

Austenal Laboratories, Inc.

THE use of Vitallium nails, screws, plates and special appliances in orthopedics may be traced to the world wide acceptance of Vitallium by the dental profession. Since 1931, hundreds of thousands of Vitallium dental restorations had been constructed for constant wear in the mouth. Vitallium cast dentures have been giving the same distinctive service in dentistry as Vitallium bone appliances are now rendering in orthopedic surgery.

Vitallium was developed by Mr. R. W. Erdle and Mr. C. H. Prange, M.E., of Austenal Laboratories, Inc., during the period from 1928 to 1931. Austenal at that time specialized in the production of stainless steel swaged denture bases, made by a process that was developed specifically for this application, involving the making of hard metal dies and counter dies, annealing under hydrogen, hydraulic swaging and spotwelding.

For years, Messrs. Erdle & Prange had realized that the then existing alloys, had many short comings and undesirable qualities. They believed that there was a need for a casting alloy, which would have all the desirable properties of the very best casting golds, but at the same time would be devoid of their disadvantages and shortcomings.

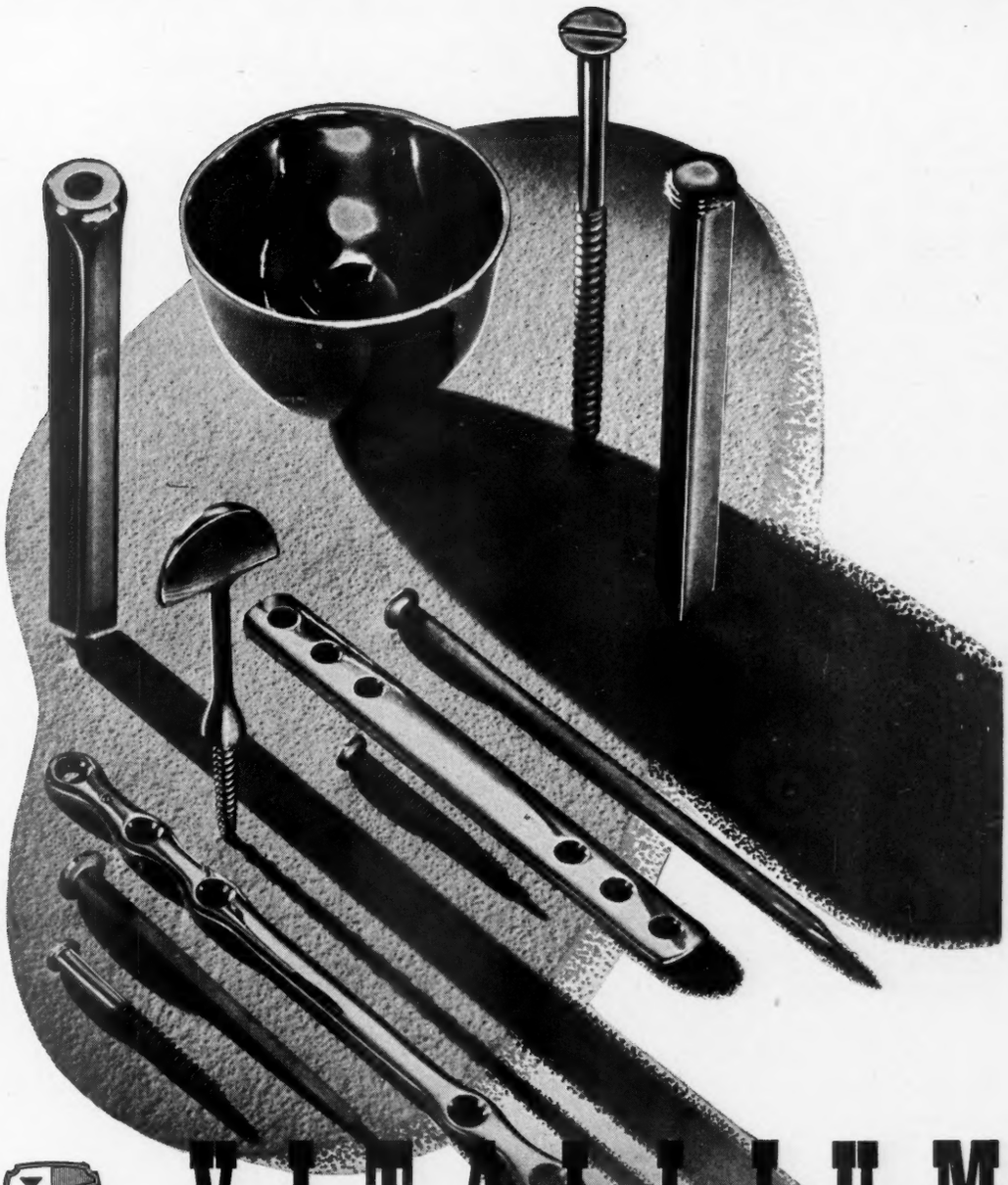
The original alloy which was perfected into Vitallium was first used in 1929. Many different alloys were tested in actual use. Many refinements and improvements were made to create a metal with the desired chemical and physical properties, and at the same time every effort was exerted towards the perfection of an economical and efficient production technic, and the development of suitable materials. This resulted in the Microcast Technic, involving the use of a unique, highly refractory investment material, a new method of spruing, burning out, casting at temperatures ranging up to 3000°F., sandblasting, hand finishing, polishing, acid treatment and the most rigid sort of inspection.

Its greater strength, cleanliness, its unusually high degree of corrosion resistance, lightness of weight, its permanently brilliant lustre caused Vitallium to be recognized as an outstanding improvement in prosthetic dentistry. The demand for these appliances has grown steadily ever since. In the face of conventional methods, the acceptance of Vitallium by the dental profession has grown, not erratically but steadily from year to year, until today over 200 licensed and distributing laboratories in North America alone are constructing about 12,000 made-to-order cast removable dental appliances every month.

The application of Vitallium to orthopedic surgery dates back to about 1936, when Dr. C. S. Venable and Dr. W. G. Stuck, of San Antonio, confirmed through their experiments with dogs that Vitallium is and remains completely inert in living tissue. Inspection of cases since then has demonstrated that Vitallium bone appliances after insertion in living tissue for a period of over three years have remained absolutely bright and unaffected and that there is no discoloration in the surrounding bone or tissue.

The remarkable success of Vitallium caps in hip arthroplasty has entailed extensive experimental work relating to arthroplasty of the shoulder, knee, elbow, wrist, finger joints and the temporomandibular joint.

Since Vitallium is cast rather than machined, it is possible to construct appliances of complicated design, which if machined, forged and assembled, could be made only with extreme difficulty and at high cost.



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SYMBOL OF SURGICAL AND DENTAL EXCELLENCE

• In surgery, the practical service of ***Vitallium nails, screws, plates, hip caps and special appliances has been "epoch-making." They do not interfere with normal bone regeneration; are neutral, chemically inert, strong, tough, free from irritation, unaffected by body fluids. In dentistry restorations of Vitallium have long since established their excellence.

The only true Cobalt-Chromium alloy being used in bone surgery.

AUSTENAL LABORATORIES • INC.

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***Venable, Stuck and Beach, Trans. Southern Surgical Assn., Vol. 49, 1937 • Venable and Stuck, Journal of Indiana Medical Assn., Vol. 31, July, 1938 • Hopkins and Zuck, Medical Bulletin of the Veterans' Administration, Vol. 15, July, 1938 • Venable and Stuck, Journal of American Medical Assn., Vol. 111, No. 15, Oct., 1938 • Hopkins and Zuck, Medical Bulletin of the Veterans' Administration, Vol. 15, No. 3, Jan., 1939 • Smith-Petersen, M. N., The Journal of Bone and Joint Surgery, Vol. 21, No. 2, April, 1939 • Strock, Alvin E., American Journal of Orthodontics & Oral Surgery, Vol. 25, May, 1939.

The G. F. Harvey Company

THERE was ice on the pails every morning up the Kaydeross during those long hard winters back in the eighties. Deliveries were erratic and industrial research was a thing unknown when that ambitious and progressive promoter, G. F. Harvey, began rolling out pills at Saratoga.

Many physicians who were among the first to buy from Harvey recall the day when they would see him sauntering down the road, his long beard flowing in the wind and his small satchel of pills tied over his shoulder with a rope. In time Harvey's knack of making pills became known to physicians throughout the Champlain valley. The demands on him increased so much that he had to give up his practice of calling personally on all of his customers.

After seven years, business increased to such an extent that in 1887 The G. F. Harvey Company was incorporated and the meagre equipment removed from the kitchen of Harvey's house into a large frame building at Saratoga. A part of that building is still in use. Before long, druggists were selling an everwidening group of physicians and by 1900 the name of Harvey had been spread from Maine to Texas. The Columbian Exposition of 1893, in which the Harvey exhibit won the Gold Medal, marks the day when the Harvey Company attained national proportions.

The Harvey Company is one of those firms which many a physician recalls from childhood days spent around his father's or grandfather's office. The "eye-for-business" aggressiveness that has characterized the rapid growth of some of our larger pharmaceutical houses in the past twenty years has been less evident in this conservative group of Upstate New Yorkers, but as the older personnel gave way to the younger the inevitable modernization has come to the Harvey Company.

As an outward symbol of the new regime stands the Research and Administration building completed late in 1939, which houses the most modern tools of scientific investigation and product control.

Possibly the first in an industry dominated by personally owned concerns, the Harvey Company has introduced multiple management to pharmaceutical manufacturing. Three men, a master in chemistry, a physician, and a field-trained sales executive, constitute the governing board. The laboratory staff is headed by a biological chemist of national repute, among whose assistants is a man who recently left the associate directorship of the Royal Institute of Public Health at Stockholm. The facilities of the laboratories are being utilized at present chiefly in the fields of antisepsis and endocrinology.

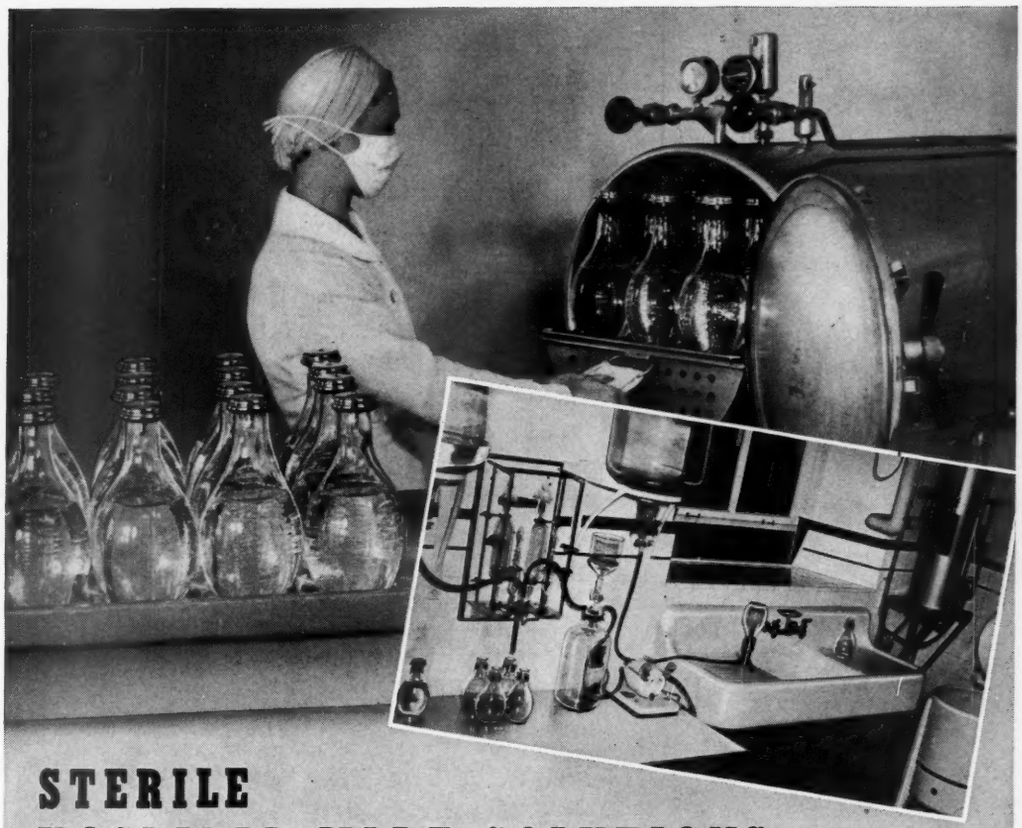
This is the Harvey Company of Saratoga Springs, home also of the queen of American race tracks and America's greatest spa. Old G. F. Harvey would recognize the spirit of the organization and the clean, cool breezes from the Adirondacks and Berkshires as his only heritage to the modern pharmaceutical plant of today.

The introduction of OILZO (Saturated Solution of Triolein Ozonide in olive oil) marks a new form of antisepsis. As distinguished from antiseptics containing heavy metals, OILZO does *not* injure healthy tissues during its sustained fungicidal and bactericidal release of nascent oxygen. Clinical investigations by competent authorities demonstrate conclusively the "bland power" of OILZO. Available in 1, 4, and 16-ounce bottles. Literature and trial clinical supply.
THE G. F. HARVEY COMPANY, SARATOGA SPRINGS, N. Y.

Macalaster Bicknell Company

The Macalaster Bicknell Company was started in 1920 by Fred S. Macalaster and Alfred Bicknell at Cambridge, Massachusetts. These men were glass blowers of the old school, experienced in fabricating soft glass, pyrex and fused quartz. They located in Cambridge to serve the research people of this large educational and medical center. The last decade has seen rapid progress in the development of research laboratories and their business has grown to fulfill these needs. Always vitally interested in making special apparatus for research, they also have increased their facilities to offer a full line of equipment for educational, medical and industrial laboratories.

From time to time many research problems and ideas, which are developed in part by the services of scientific glass blowing, have become standard technics for the medical and industrial field. Notable is a method of producing, sterilizing, storing and dispensing under hermetic seal parenteral fluids. In co-operation with the research people at the Harvard Medical School and the Peter Bent Brigham Hospital, this development was brought into being and finally offered as a standard technic for all hospitals. It may be interesting to note that until this happened, hospitals had been struggling to handle hospital-made parenteral fluids without specifically designed apparatus. Thus the combination of the research people and scientific glass worker produces a time saving and cost reducing equipment for the general hospital. In 1935, the Company took a further step in opening a branch in New Haven, Connecticut, to serve the customers in that educational and industrial area.



STERILE HOSPITAL-MADE SOLUTIONS

can be stored indefinitely in

FENWAL CONTAINER-DISPENSERS

without impairing their value as safe parenteral fluids*

A FENWAL Installation will enable your hospital to prepare *safe* parenteral fluids at a per-unit cost so low, as to permit adequate therapy to be given all patients in whom it is indicated.

Intravenous injections of chemically pure, sterile solutions will not cause untoward allergic or febrile reaction. The records of hundreds of hospitals which have adopted the standardized Fenwal Technic, offer conclusive evidence in support of the findings of able investigators.

*Annals of Surgery, 1940, 112:4, 603-625.

We invite your direct inquiry

MACALASTER BICKNELL COMPANY

171 Washington Street Boston, Massachusetts

Fenwal

THE SOLUTION DESIRED AT THE INSTANT REQUIRED

W. A. Baum Co., Inc.

THIS firm from its inception has devoted its efforts exclusively to the perfecting of bloodpressure apparatus.

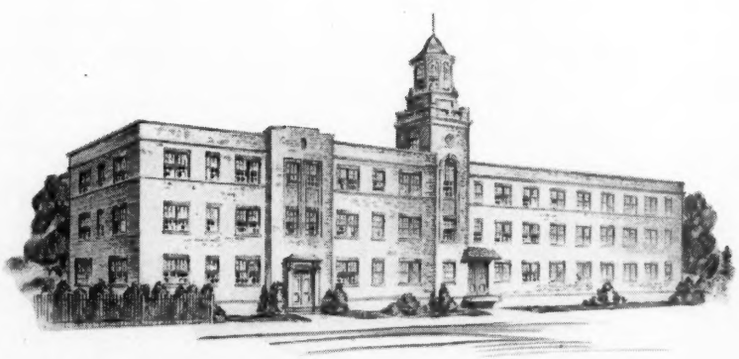
In 1916, the *original* Baumanometer pioneered the method of scientific accuracy by individual calibration . . . the wide-bore tube . . . the nonoscillating, nonspilling mercury column . . . with a simplicity of design which eliminated troublesome valves, scale adjustments, etc., . . . and other epochal improvements in bloodpressure apparatus.

The *Lifetime* Baumanometer was originated in 1925. The unique construction of this instrument combined all the previous desirable features, and introduced for the first time, a bloodpressure instrument with an accurately interchangeable glass tube, in combination with a standardized steel reservoir. The glass or breakable part of the instrument was reduced to a single, straight, thick-walled tube.

Many improvements followed in successive years, until the *Lifetime* Baumanometer was finally housed in a one-piece die cast Duralumin case, lighter, smaller and many times stronger than materials previously used. More than two hundred thousand Baumanometers have been sold throughout the World. Today the Baumanometer line embraces four Models: STANDBY, KOMPAK, THREE HUNDRED and WALL.

The STANDBY Model is *specifically* designed for office or hospital use. The EXACTILT Scale provides automatic eye-level reading from any position. A distinctive piece of equipment.

Bilhuber-Knoll Corporation



BILHUBER-KNOLL CORP. is the sales division of the original organization, E. Bilhuber, Inc., established thirty-five years ago in New York. The growth of this company has been closely identified with the progress made in the medicinal treatment of disease. Pioneering in the field of purine medication, they introduced Diuretin, the original soluble salt of theobromine. Two later developments along this line are Theocalcin and Phyllicin. Research on opiates culminated in the introduction of Dilaudid. Another of their products, Metrazol, occupies an important place as a circulatory and respiratory restorative.

The fundamental policy of this company has been to develop, prepare and market strictly original prescription chemicals. The fact that many of their products have been accepted by the Council on Pharmacy of the A. M. A. and others have found their way into the U.S.P. emphasizes the important place they occupy in medicine.

Duke Laboratories, Inc.

In 1928, the Duke Laboratories, Inc., was founded by Carl J. Herzog, who for many years was the General Manager of the H. A. Metz Laboratories, Inc., New York City.

On Hudson Street, in what is romantically referred to as "Old New York," the Duke Laboratories began manufacturing elastic adhesive plasters (they have the distinction of being the pioneers in this field in the United States), and cosmetic cremes and soaps primarily for the physicians' needs. In a very short time they expanded sufficiently to warrant their taking a factory building in Long Island City, New York, where they stayed for seven years.

In 1939, the Duke Laboratories, Inc., moved to Stamford, Connecticut, into an ultramodern factory building amid pleasant surroundings, and here they are manufacturing elastic adhesive plasters, surgical dressings, and specialties, also cosmetic cremes, superfatted soaps, etc.

FOR THE PATIENT'S COMFORT

ELASTOPLAST

Reg. U. S. Pat. Off.

The Dependable
Original
E-L-A-S-T-I-C
Adhesive
Plaster Bandage

Permits controllable compression. Provides effective, continuous support.

THE flexible Elastoplast bandage is made of the finest American cotton yarns and is adhesive surfaced . . . therefore no slipping.

Equally valuable and time-saving in office and hospital work . . . Elastoplast is the bandage of choice in varicose ulcers, strains, injuries to joints, tendons, muscles, for strapping of chest . . . wherever an elastic support, efficacious compression and comfortable dressing is necessary.

Obtainable from your dealer in air-tight blue and white tins—in widths of 1, 2, 2½, 3, 4, 5, and 6″ (approx. 5½ yards long fully stretched).

DUKE LABORATORIES, INC. STAMFORD, CONN.

Write for Illustrated Elastoplast Manual. A sample of Nivea, the surgeon's hand lotion will be included.

The Cook County Graduate School of Medicine

HOUSED in its own adequately equipped building, located in Chicago within a block of the Cook County Hospital and affiliated definitely with that institution, the largest general hospital in the world, the Cook County Graduate School of Medicine was permanently established in 1932 as a nonprofit corporation offering specific post-graduate instruction in general practice, in surgery and in the specialties to qualified members of the organized medical profession. The faculty members, all of whom are outstanding specialists in their respective fields, are drawn altogether from the Attending Staff of the Cook County Hospital. The patients of that hospital, averaging about 75,000 annually and about 300,000 visits to the out-patient clinics, are freely available to the school for instructional purposes. Cases of practically every type of physical and mental ailment likely to be encountered in this part of the world are to be found among the hospital patients at almost any time.

Instruction in the various courses is given in clinics, in clinical and pathologic laboratories, in the wards, operating rooms and out-patient departments, and includes lectures, demonstrations and practice on anesthetized dogs. The enrollment at the school averages approximately 900 annually, the register showing that students have attended from every state in the Union and from numerous foreign nations, especially Canada and Central and South American countries. The school is devoted entirely to modern, practical graduate teaching and offers no degree of any kind.

COOK COUNTY
GRADUATE SCHOOL OF MEDICINE

(In affiliation with COOK COUNTY HOSPITAL)

Incorporated not for profit

Announces continuous courses

SURGERY—Two Weeks Intensive Course in Surgical Technique with practice on living tissue, starting every two weeks. General Courses One, Two, Three and Six Months; Clinical Courses; Special Courses. Rectal Surgery every week.

GYNECOLOGY—Two Weeks Intensive Course starting February 24th and April 7th. Clinical, Diagnostic and Didactic Course every week.

OBSTETRICS—Two Weeks Intensive Course starting April 21st. Informal Course every week.

ROENTGENOLOGY—Courses in X-Ray Interpretation, Fluoroscopy, Deep X-Ray Therapy every week.

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OTOLARYNGOLOGY—Two Weeks Intensive Course starting April 7th. Informal and Personal Courses every week.

OPHTHALMOLOGY—Two Weeks Intensive Course starting April 21st. Informal Course every week.

GENERAL, INTENSIVE AND SPECIAL COURSES IN ALL BRANCHES OF MEDICINE, SURGERY AND THE SPECIALTIES

Teaching Faculty—Attending Staff of

COOK COUNTY HOSPITAL

Address: Registrar **427 South Honore Street, Chicago, Illinois**

New York Polyclinic Medical School and Hospital

THE New York Polyclinic Medical School and Hospital, founded by Dr. John A. Wyeth in association with a distinguished group of confreres, was organized in 1881. It is the pioneer postgraduate medical school in America and has had on its staff many prominent members of the medical profession. The influence this educational movement has exercised is expressed in the Boston Transcript of November 17, 1914: "Nor can there be any question that the establishment of the Polyclinic was the chief stimulus to the advance of medical thought and science in the United States—a stimulus that was felt not only throughout this country in all of whose important cities one or more postgraduate medical schools have been founded but across the sea as well, where this system has been followed in London and other cities." The original institution, established on 34th Street, moved to new quarters on 50th Street in 1912.

In 1929, it was found necessary to erect a new twelve-story building which adjoins the main building, in order to increase the teaching facilities and provide additional clinic accommodations.

The present institution is thoroughly modern in personnel and equipment. It has accommodations for 450 patients. The Pathological, Roentgenological and Physical Therapy Laboratories are unexcelled.

THE NEW YORK POLYCLINIC

MEDICAL SCHOOL AND HOSPITAL

(ORGANIZED 1881)

(The Pioneer Post-Graduate Medical Institution in America)

OBSTETRICS AND GYNECOLOGY

A full time course. In Obstetrics: lectures; prenatal clinics; witnessing normal and operative deliveries; operative obstetrics (manikin). In Gynecology: lectures; touch clinics; witnessing operations; examination of patients pre-operatively; follow-up in wards post-operatively. Obstetrical and Gynecological pathology. Regional anesthesia (cadaver). Attendance at conferences in Obstetrics and Gynecology. Operative Gynecology (cadaver).

FOR THE GENERAL PRACTITIONER

Intensive full time instruction in those subjects which are of particular interest to the physician in general practice. The course covers all branches of Medicine and Surgery.

FOR INFORMATION ADDRESS

MEDICAL EXECUTIVE OFFICER, 345 West 50th Street, NEW YORK CITY

The Upjohn Company

A SMALL, crude home laboratory of a country practitioner to a major industry—that is the Upjohn story of the past half-century. Founded in 1886 by Dr. William E. Upjohn, a young practicing physician of Hastings, Michigan, The Upjohn Pill and Granule Company was inaugurated for the purpose of manufacturing "Friable Pills." These were the results of Dr. Upjohn's attempts to aggregate powdered drugs into a globular form which could be readily crushed and which would not harden. As soon as he was satisfied that his product could be offered commercially, Dr. Upjohn moved to Kalamazoo, taking as partners first an older brother, Dr. Henry U. Upjohn, and a little later two younger brothers, Mr. Frederick Upjohn and Dr. James T. Upjohn.

The "Friable Pills" were not coated when first offered; but in order to compete with the popular sugar coated pills, a method of coating was devised whereby the pills could be provided in a wide range of attractive colors and with a high polish. The line included quite an extensive variety of formulas. Of these, Quinine Pills soon became conspicuous, since quinine, then a very popular drug, was used in enormous quantities.

Toward the end of the nineteenth century the Company gradually included other pharmaceutical preparations: fluidextracts, tinctures, elixirs, ointments and compressed tablets. Growing recognition of the great possibilities in the pharmaceutical field led to a reorganization in 1902 and the name was changed to The Upjohn Company.

The period of early growth found the Company facing severe competition, though it is probable that there were unrecognized favorable factors at the time in the growing power of the Food and Drugs Administration under the Food and Drugs Act of 1906. This tendency was in perfect accord with the Upjohn policy. Since three of the four original members of the firm were physicians, the attitude and policies of The Upjohn Company had been from the outset determined by and directed toward the physician.

This close co-operation with the physician and the legitimate pharmaceutical industry led to the foundation and development of the Upjohn research laboratories. A highly trained chemical and biological research staff was assembled which has continued to grow year by year. At the present time, laboratories are maintained in bacteriology, pharmacology, endocrinology, pharmaceutical chemistry, biological chemistry, organic and analytical chemistry, vitamin research and nutrition. In this connection, fellowships were awarded which enabled the recipients to continue their research projects in the Upjohn laboratories. Outside fellowships were established in various universities, laboratories, and clinics.

Only one capsule per day
to fortify your patients'
daily intake of these vitamins
Vitamin A, ... 10,000 U.S.P. units
Vitamin D, ... 1,000 U.S.P. units
Vitamin C, ... 500 International units
(25 mg. ascorbic acid)
Vitamin B1, ... 500 International units
Vitamin B2, ... 200 gammas
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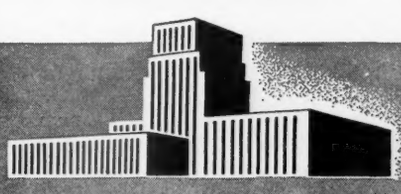
Nicotinamide, ... 20 milligrams
100 Capsules
Unicap® Vitamins

No longer need the patient have the inconvenience and the expense of taking, separately, the fat-soluble vitamins—the vitamins of the B complex group and vitamin C. Now only one Unicap a day is necessary to fortify the average diet. A capsule taken regularly each morning soon becomes a part of daily routine. This results in simplicity and economy in vitamin administration.

Unicap Vitamins

are available from your prescription druggist in packages of 24 and 100



Upjohn

KALAMAZOO MICHIGAN

★ *Fine Pharmaceuticals Since 1886* ★

Frederick Stearns & Company

YEARS ago people judged the potency of drug preparations by their bad taste and the amount of sediment in the bottle. Crude drug roots, herbs and leaves were crushed in iron mortors; maceration was accomplished in small crocks: distillation was performed in inefficient stills heated by wood or coal; filtration was crude at best. Under these circumstances, the standard of purity as we know it today, was impossible.

That was the picture when young Frederick Stearns, on January 1, 1855, went from Windsor, Canada, on his journey from Buffalo to carve out a career in the growing metropolis of Detroit. His interest lay in the manufacture of drugs and soon after his arrival he founded Frederick Stearns & Company. The history of the House of Stearns is virtually a history of the drug industry in the United States.

The founder early perceived that it was absurd for a retail pharmacist with limited means, crude equipment and the constant necessity of being behind his counter to waste his time in making his own preparations. Consequently, with a well selected stock of drug preparations that would satisfy any demand, he knew he could eliminate much of the special compounding which entailed loss of time and trade. That was the basis of Stearns' policy and his success proved his analysis correct.

Frederick Stearns was the originator of the principle of manufacturing in a central laboratory medicinal products of a non-secret nature, each with full directions for use and the formula or list of ingredients on the label. The proof of his wisdom is brought to us now when our government demands that every drug product be similarly labelled and identified.

In 1887, Mr. Stearns resigned from active management of the organization, leaving a heritage of sound business principles a name that was respected in the industry and a son who was prepared to follow in his footsteps. Frederick Kimball Stearns had received not only good counsel from the founder but a thorough, practical knowledge of all phases of the business. He expanded the business to many times its original volume. Shortly after his appointment, he established branches in all parts of this country and sent representatives to many foreign countries. Uninterrupted progress in business compelled additional construction of modern buildings. In 1919, the Stearns' Plant took on its present form, occupying four and one-half acres of ground, and buildings containing 415,485 square feet of floor space.

Shortly after the World's Columbian Exposition in 1896, the company developed the principle of scientific medication and opened a laboratory which now houses a large research staff concerned with the scientific improvement in the production of organic and biochemical products. To that the company added a department of pharmacology to further the development of the research department.

The company is known for its introduction of the first fluid extracts in America, developing and perfecting aromatic cascara, the manufacture of soluble elastic capsules, digestive ferments and ethical specialties.

Today the House of Stearns is enjoying a period of prosperity and plans to continue the service it has rendered for eighty-five years. Of the hundreds of products produced, some of the best known are: Neo-Synephrin, Mucilose, Gastric Mucin, Trimax, Kasagra, Appella Apple Powder, Astring-o-sol, Cyverine, Ferrous Gluconate, Potassium Gluconate, Susto and a complete line of all Vitamin Products.

Fred Haslam & Company, Inc.

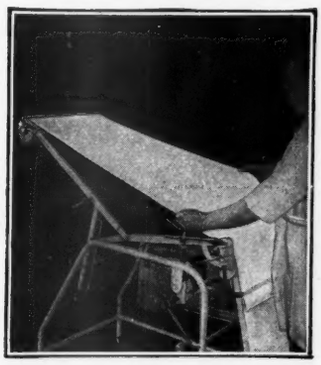
FRED HASLAM & CO., of 83 Pulaski Street, Brooklyn, New York, originated in Boston about 1848. The founder, Fred Haslam, learned the surgical instrument trade in England. He came to this country when he was about twenty-three years of age, with little capital except his knowledge and ability.

In 1857, he moved his family and business to Brooklyn, and established his drop-forge and office on the site of the present building. As the city grew, the forge had to be moved away from the residential neighborhood, but the office on Pulaski Street has remained in the same location ever since Mr. Haslam set up business in Brooklyn. The present building erected in 1877 replaced the original structure.

When Mr. Haslam retired, his son-in-law, Mr. Wm. H. Hamilton, became president and held that position until his death in 1915, at which time Mr. John J. Douglass, was made president. Upon his retirement in 1934 his brother, Alfred R. Douglass, succeeded him. Frederic M. Haslam took over the management after the death of Mr. Alfred R. Douglass.

The Company has always striven to maintain the high standard of quality of the surgical instruments manufactured and sold under the name of Fred Haslam. Mr. Haslam had much to do in encouraging the use of stainless steel in Surgical Instruments.

As in the previous war, the Company has again been called upon by the United States Government to supply its needs in its defense problems. Despite this pressure, Fred Haslam & Co. is still maintaining its standard of service and quality.



Vanco Sanitary Sheet Apparatus

A Clean Sheet for Every Patient

A NEW CLEAN, WHITE PAPER SHEET IS PULLED DOWN ON THE EXAMINING TABLE.

BY A SIMPLE TEAR, THE SHEET IS REMOVED FROM THE TABLE.

COVERED AGAIN WITH A NEW SHEET, THE TABLE IS READY FOR THE NEXT PATIENT.

Adjustable and easily attached to either wood or metal table, this *Vanco* fixture holds approximately 400 sheets of soft, snow-white paper of special pliable texture.

Fastidious patients will welcome this innovation. Neat. Sanitary. Comfortable. An ingenious device prevents slipping of sheet, and affords complete protection for your patients.

No more laundry bills. No more expense for new linen. Vanco complete $10.50 each. Extra rolls (approximately 300 applications) $3.00 each.

Patented

Write for literature.

Order through your dealer.

FRED HASLAM & CO., INC.

83 Pulaski St. Brooklyn, N. Y.

for the best in blades

To-day...

demand the greater rigidity and balance of 1/3 more steel—the Mikro-keen edges created by longer bevels—and now the new refinement in edging: **Gripping Edge.** Developed for surgery with the aid of leading surgeons, it makes a clean, straight line incision with ease and precision through tough and elastic skin.

specify CRESCENT
SURGICAL BLADES
At your surgical dealer

CRESCENT SURGICAL SALES COMPANY, 440 FOURTH AVENUE, NEW YORK CITY

Behind MERCUROCHROME

(dibrom-oxymercuri-fluorescein-sodium)

H W & D *is a background of*

Precise manufacturing methods insuring uniformity

Controlled laboratory investigation

Chemical and biological control of each lot produced

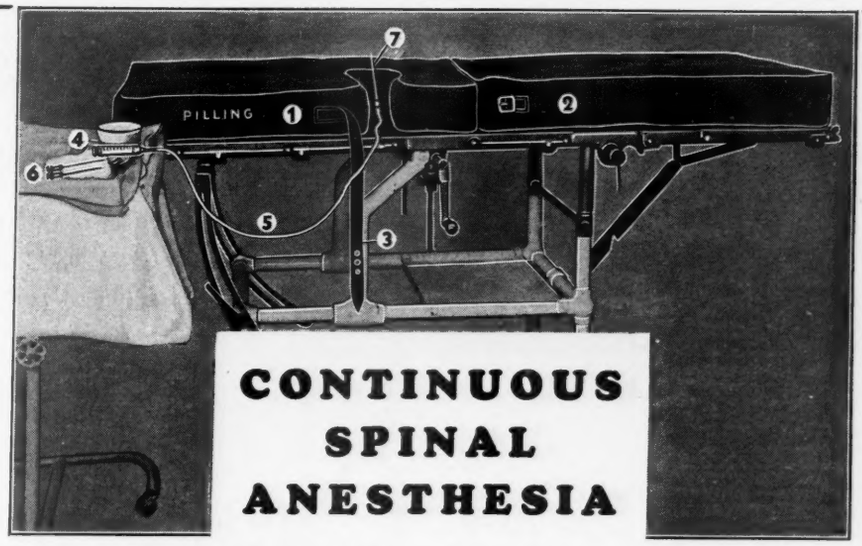
Extensive clinical application

Nineteen years' acceptance by the Council on Pharmacy and Chemistry of the American Medical Association

ACCEPTED AMERICAN MEDICAL ASSN.

A booklet summarizing the important reports on Mercurochrome and describing its various uses will be sent to physicians on request.

HYNSON, WESTCOTT & DUNNING, Inc., Baltimore, Md.



CONTINUOUS SPINAL ANESTHESIA

DR. LEMMON'S EQUIPMENT FOR CONTINUOUS SPINAL ANESTHESIA

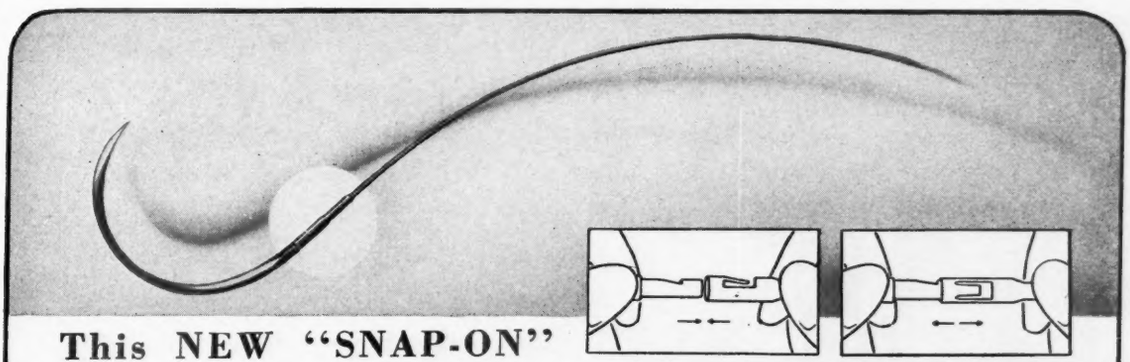
Wm. T. Lemmon, M. D., Philadelphia

Described in the January, 1940, issue, "Annals of Surgery". Includes cushion and accessories. (May be used on any operating table.)

REPRINT ON APPLICATION

Made and Sold By

THE GEORGE P. **PILLING** & SON COMPANY
Arch and 23rd Streets — Philadelphia, Pa., U.S.A.



This NEW "SNAP-ON" NEEDLE Does Not Have to be Threaded or Re-Threaded

Streamlined at the Joint — One Suture Thickness Only

The new Reese *Snap-on* Needle, with the special D & G suture to which the self-latching clip is attached, eliminates double-thickness of suture at the eye. This stream-lining notably minimizes trauma to delicate tissues.

You simply snap-on the suture; it holds firmly. The needle may be pulled without an assisting hand to take up the slack; annoying unthreading is eliminated. The Reese *Snap-on* Needle has a special concave shank assuring a firm "bite" with the needle-holder; swaged taper points give maximum strength. Note how the suture is easily unfastened and the needle used again. Ask your surgical instrument dealer to show you this outstanding needle and the special D & G sutures to be used with it.

The Reese SNAP-ON Needle is a product of
MacGREGOR INSTRUMENT COMPANY, Needham, Mass., U.S.A.

LORAGA

To the Queen's Taste

When you prescribe for Betty Jane or Mary of the average family, you may have just as finicky a taste to consider as if your prescription were intended for the Queen. Disagreeable "medicine" makes disagreeable children if, over their determined objections, it can be forced down their throats at all.

Truly fit "to the Queen's taste" is LORAGA, yet this plain mineral oil emulsion is not disguised by artificial flavoring. There is no oily after-taste. But Loraga not merely caters to the exacting palate of adult or child—it is a fine emulsion that mixes well with the intestinal contents, softens and lubricates the mass so that evacuation may not be delayed and may take place without straining.

Once you use Loraga, you will prescribe it again and again. You will like its trouble-free effectiveness. For an immediate trial, ask for a complimentary supply on your letterhead.

Loraga is available in 16-ounce bottles.

WILLIAM R. WARNER & CO., INC.
113 West Eighteenth Street, New York City

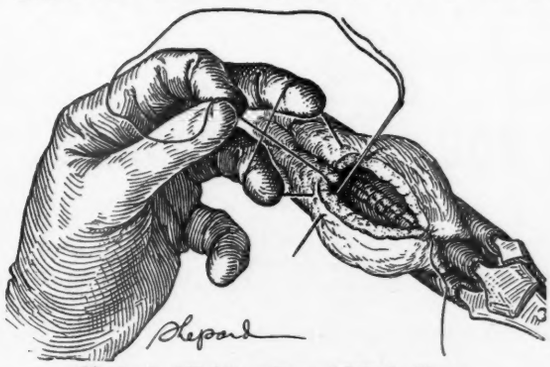
Chicago Post-Graduate School of Surgery

THE Chicago Post-Graduate School of Surgery was founded in 1917 by E. A. Printy, M. D. Up to 1938, the school was known as The Laboratory of Surgical Technique.

The teaching staff is made up of university men of recognized teaching ability, who for years have been engaged in post-graduate instruction. The objective of the school is to furnish a laboratory where qualified surgeons are given the opportunity to perfect their surgical skill.

The Chicago Post-Graduate School of Surgery is now under the directorship of A. V. Partipilo, M.D., who has been associated with the institution since 1925.

Actual Practice in Surgical Technique



Method of Holding Connel Stitch. From Principles of Operative Surgery, by A. V. Partipilo, M. D.

Special Courses—

Urology . Cystoscopy . Orthopedic Surgery . Thoracic Surgery . Surgical Pathology . Laboratory Diagnosis and Technique . Bronchoscopy . Eye, Ear, Nose, and Throat . Goiter Surgery . Gynecology . Surgical Anatomy . Proctology

Visitors always welcome

CHICAGO POST-GRADUATE SCHOOL OF SURGERY

(Formerly—Laboratory of Surgical Technique)

Incorporated not for profit

Near Cook County Hospital

1. Two-Weeks Surgical Technique Course: rotary course continued throughout the year. Combines Clinical Teaching and ACTUAL PRACTICE BY THE STUDENTS under competent supervision. A review of the necessary Surgical Anatomy is embraced in the work.
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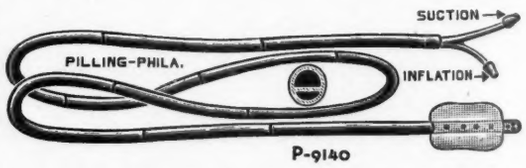
This double channel tube principle is used for three special purposes. First, for treating and diagnosing obstructive lesions of small intestines; second, for controlling patient with intestinal obstruction by enabling him to feed yet to draw off residue above point of blockage; third, for use after gastro-enterostomy.

The lumen used for suction may also be used for the injection of barium sulphate suspension in making roentgenological studies of small intestinal lesions. Circular describing the above Instrument sent on request.



P9140 Miller-Abbott double lumen tube . . . $7.50

TECHNIQUE Circular on request with technique and bibliography.

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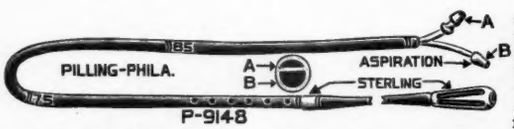

Double Barrelled Gastro-Enterostomy Tubes (Abbott-Rawson) P9148 is designed for the post-operative care of malnourished patients subjected to any form of operative procedure anastomosing the stomach to the small intestine. The tube is so constructed that a single lumened section leads up from the "bucket" (bucket is of sterling silver) at the tip for 30 cm. at this point. A second and larger lumen begins and continues throughbut the remaining length of the tube.

See Journal of the American Medical Association, June 10, 1939. Annals of Surgery, October 1940. Price.....$6.50

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Alba Pharmaceutical Co., Inc.

Phenomena first, then judgment, then general propositions, then practical knowledge and craft,—Hippocrates.

It was with this understanding of the basic problems involved that the Alba Pharmaceutical Company was founded in 1936 for the purpose of creating and distributing new ethical products for which scientific medical research indicated a need.

In the four years since its founding the Alba Pharmaceutical Company has played no small part in the medical advances of the period. Its founders, from long experience with old established pharmaceutical lines, had a rich background from which to draw. This experience, coupled with a high conception of its purpose and a deep appreciation of its problems, has resulted in the building of research facilities and a group of products which companies much older in years would unquestionably consider distinguished.

In the course of the progressive step proceeding from broad general premises to concrete application, all preparations originating in the Alba laboratories are studied from every possible chemical and pharmacologic standpoint and clinical work is instituted by the Department of Clinical Research only after the therapeutic efficiency and tolerance of these preparations are indubitably established by numerous experiments.

Through close co-operation with the leading hospitals and clinics in all sections of the country, all preparations are subjected to the most meticulous and thorough evaluation; only after their use on thousands of cases proves their therapeutic merit and safety and defines their indications, are they made known to the medical profession.

In the manufacture of Alba products the highest standards are maintained by the laboratory and production units to provide chemicals of utmost purity and uniformity of composition.

Although Alba had existed for less than a year at the time, it contributed in no small measure to the development of Sulfanilamide, and was one of the first to introduce this product (Stramid) to the medical profession. Through constant research, other sulfonamide products were evolved. The latest sulfonamide derivative contributed by this Company is Sulfathiazole, introduced in 1940.

While much research was being expended in quest of chemotherapeutic agents, an antiseptic and germicide with high bactericidal potency was developed and introduced in 1938 under the name of ZEPHIRAN. This antiseptic, employed for preoperative preparation of the skin exhibits detergent and wetting properties with rapid destructive action on microbes.

Noteworthy also was the introduction of Benzylephedrine, an active ingredient in Franol for the symptomatic treatment of asthma. The most logical therapy in peptic ulcer and symptomatic hyperacidity is Creamalin, a cream of amphoteric aluminum hydroxide. Alba scientists have originated a process of desiccating Creamalin and have made possible active aluminum hydroxide in tablet form.

Work now in progress indicates that even greater contributions to medicine may be looked for in the coming year. Young in years, the Alba Pharmaceutical Company has proved its maturity in accomplishment, and plans for the future are made with the hope that it may continue to play a part in man's struggle against disease.

John Wyeth & Brother, Inc.

JOHN WYETH founded in 1860 the firm which now bears his name. Mr. Wyeth's training was always in the pharmaceutical field. His first employment was in a drug store in Pittsburgh. This awakened his interest in pharmacy and he went to Philadelphia where he enrolled for the study of pharmacy at the Philadelphia College of Pharmacy. He was graduated in 1854.

His first position, following his acquisition of a degree in pharmacy, was with Henry C. Blair, one of the pioneer pharmacists of the city. After a few years he was admitted as a partner in the firm. Then in 1860 the firm, John Wyeth & Brother, was founded for the purpose of conducting a retail drug store. The brother was Frank H. Wyeth and the location of the new store was at 1412 Walnut Street in Philadelphia.

Although the pharmacy was begun as a retail store, John Wyeth had long been impressed with the opportunities for improvement in the manufacture of pharmaceutical specialties, a phase of the business for which he had remarkable aptitude. The manufacturing side of the business soon became its most important asset, although Mr. Wyeth frequently spoke with regret of the necessity for severing his connection with the retail phase of the business.

Among the first specialties offered the medical profession by the firm of John Wyeth & Brother was palatable standardized elixirs. John Wyeth always strove to make pharmaceuticals so that they were not only of uniform and adequate potency but were also palatable for the patient. The volume of Wyeth elixirs from the very beginning of the company attests to the success of the founder's efforts.

Other items in which the firm of John Wyeth & Brother pioneered in the field of pharmacy include: Moulded suppositories which were early offered by Wyeth as they saw the advantage of casting suppositories in moulds and thus maintaining a uniform shape and standard potency of the contained drug; Gelatin capsules, soon after their invention, were employed by Wyeth as a method of making drugs more palatable as well as insuring accurate dosage. The continuation of the firm for more than eighty years is adequate testimony to the quality of the pharmaceuticals produced and the acceptance of them by the medical profession.

From limited manufacturing facilities in the original pharmacy, the physical plant in which Wyeth pharmaceuticals are made has grown until it comprises buildings in several states and branches in foreign countries. From the very inception research in pharmacology has been a dominant part of the activities of the concern. A highly trained and well equipped research staff is constantly at work perfecting existing pharmaceuticals and anticipating the needs of the physician for newer and better drugs.

The promotional policy of the company is ethical; no advertising or promotion is directed to the laity; and every effort is expended to maintain the integrity of the physician's prescription.

More than eight decades of experience lie behind John Wyeth & Brother, Incorporated. From this much has been learned which will benefit the profession and now more than ever before personnel, physical plants and policy are prepared to serve well.

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JOHN WYETH & BROTHER, INC., PHILADELPHIA, PENNSYLVANIA

Ciba Pharmaceutical Products, Inc.

FROM a modest beginning in lower Manhattan to a new, modern plant situated in Summit, New Jersey, marks the physical progress of Ciba, ethical pharmaceutical manufacturers, during the past quarter century.

Up to 1937 the pharmaceutical division shared a large, nine-story building with the dye and chemical branch of the Ciba Company. As both departments felt the need of expansion, it was decided to transfer the pharmaceutical section to the outskirts of the metropolitan area, using the New York site solely for the dye and chemical work.

Under the new name of Ciba Pharmaceutical Products, Inc. this company purchased a tract comprising about forty acres at the corner of Morris and Madison Avenues, Summit. Arranged on a seven-acre plot the five buildings, which comprised the original group, were set back from the highway in order to feature the main building and to give less prominence to the others. Although the other units are in keeping with the main structure, they are strictly utilitarian in character, as it was believed preferable to keep the manufacturing buildings subordinate to the main edifice.

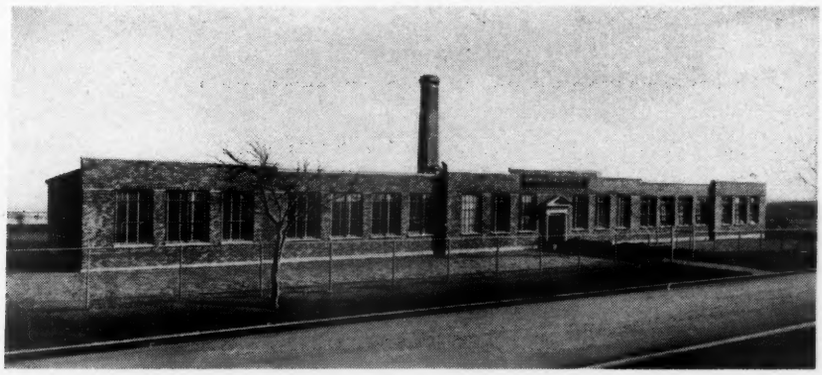
The main edifice known as "D," is entirely modern in design and construction, the outstanding feature of this trend being the air-conditioning for the comfort of employees primarily and incidentally for the use of a few departments where it is desirable from a production standpoint. Carrying out the idea of cleanliness and sanitation, tile floors are used wherever manufacturing processes are conducted. Because of the air-conditioning, doors and windows are kept tightly closed at all seasons, thus insuring a maximum of light and eliminating outside dust which might cause contamination of the specialties manufactured.

Building "C" in the background is a manufacturing structure consisting of three stories and basement with a huge tower to enclose the sprinkler and house tanks. It also contains the boiler works for supplying steam to the entire plant. The large tower clock is a distinctive identifying mark visible for some distance through the surrounding countryside. The unit known as "B" is a one-story building used chiefly for hormone manufacture while "A" of similar size functions as a cooling cellar.

Since its establishment in Summit in 1937, the popularity of this firm's products, Coramine, Digifoline, Nupercainal, etc., increased to such an extent as to necessitate the construction of control laboratories and an animal house in the spring of 1938. Further expansion in the chemical manufacturing, packaging and administration buildings was made during the past summer to keep pace with the development of Ciba's prominence in the hormone field. This company is now recognized as one of the outstanding houses in the endocrine field because of the rapid strides which have been made with their particular brands of testosterone propionate, estrogenic, progestational and adrenocortical substances marketed under the trade names of Perandren, Ovocylin, Ben-Ovocylin, Di-Ovocylin, Lutocylin and Percorten, respectively. At the present time Sulfathiazole is Ciba's most recent contribution to the medical armamentarium.

Members of the medical and related professions are cordially invited to inspect the plant or to contact the various departments for information relative to their progress in medical science.

Ortho Products, Inc.



ORTHO PRODUCTS, INC., Linden, New Jersey, specializes in scientific materials to be used for the control of human fertility. The company is a complete entity, from research to marketing. The principal products at this time are Ortho-Gynol Vaginal Jelly and Ortho Diaphragms.

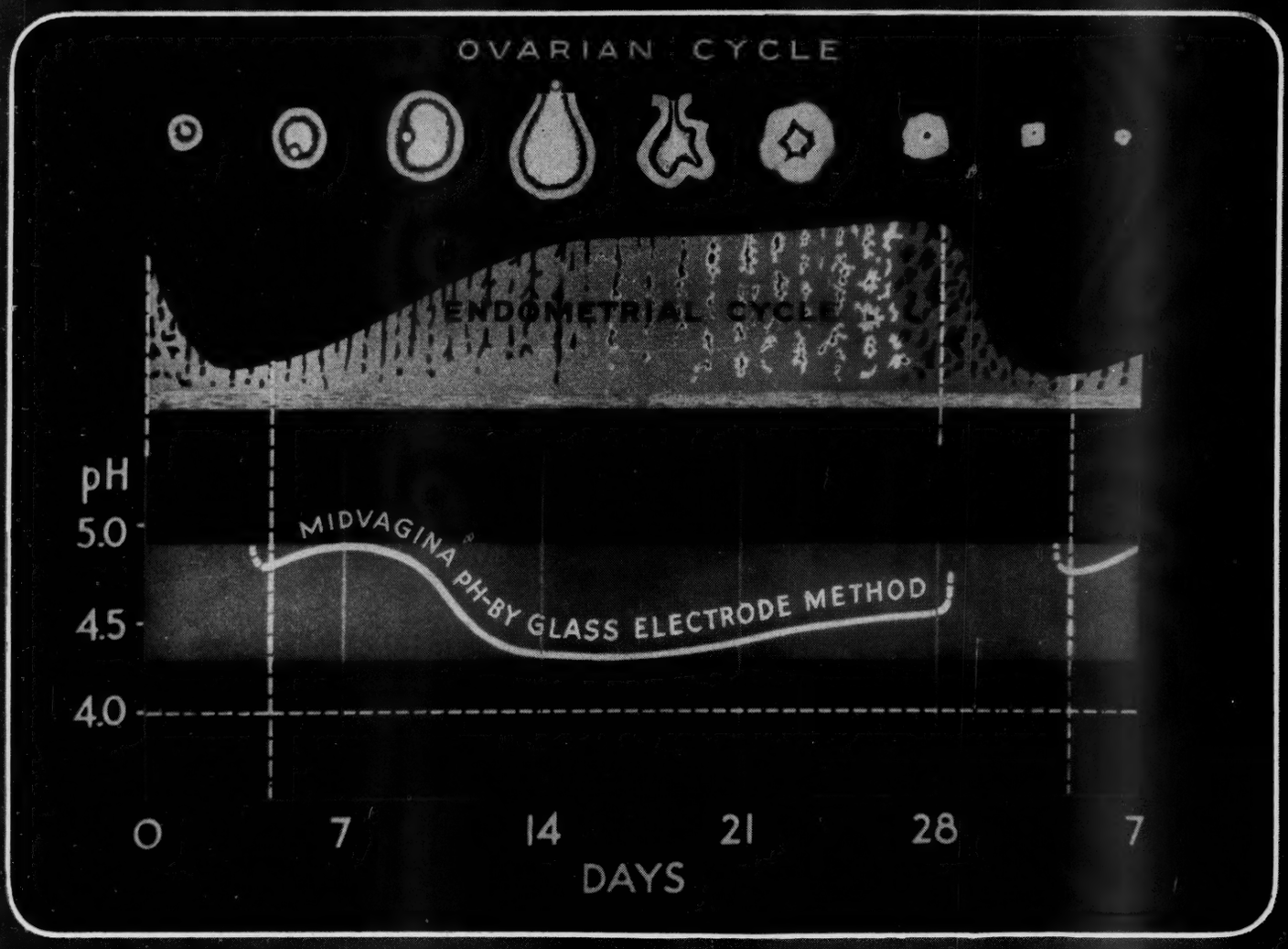
The Ortho Products research program has many facets. From a completely equipped development and control laboratory on the premises, the research work extends into all fruitful fields. Projects are sponsored in universities, hospitals, clinics and independent laboratories. The purposes of the research program are to discover even more effective materials and simpler, more acceptable methods.

As new data and new materials and methods are proved dependable, they are offered to the medical profession in the media most adaptable. Brief facts and features are presented in the regular monthly announcement of Ortho Products on the last page of each issue of the American Journal of Surgery. More lengthy reports of tests and advancements are incorporated into illustrated bulletins which are sent to interested physicians without charge. Scientific papers on the general theme of the control of fertility are purchased as reprints from the journals of source and distributed by the nation-wide Ortho Products detail staff.

The motion picture is another medium employed by Ortho Products. Medical societies, colleges and other recognized groups may arrange for showings, without charge, of the new talking-motion picture, "Studies in Human Fertility—Methods for the Control of Conception." This film has been acclaimed an outstanding contribution to medical teaching by large groups of prominent gynecologists.

The continuity of the film is the address of a professor to his class. He mentions the progress of medicine through the three basic controls, the control of infection, the control of communicable disease and the control of pain, "to which we may now add a fourth, the all-important control of conception." Following a review of the basic physiology and anatomy of reproduction, there is a complete discussion of desirable and undesirable methods and materials for the control of conception. The desirable methods are discussed and illustrated in great detail. The film contains no advertising.

Physicians interested in a showing of the film are invited to write to Ortho Products, Linden, New Jersey.



From the motion picture, "Studies in Human Fertility," by Ortho Products, Inc.

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The American Journal of Surgery

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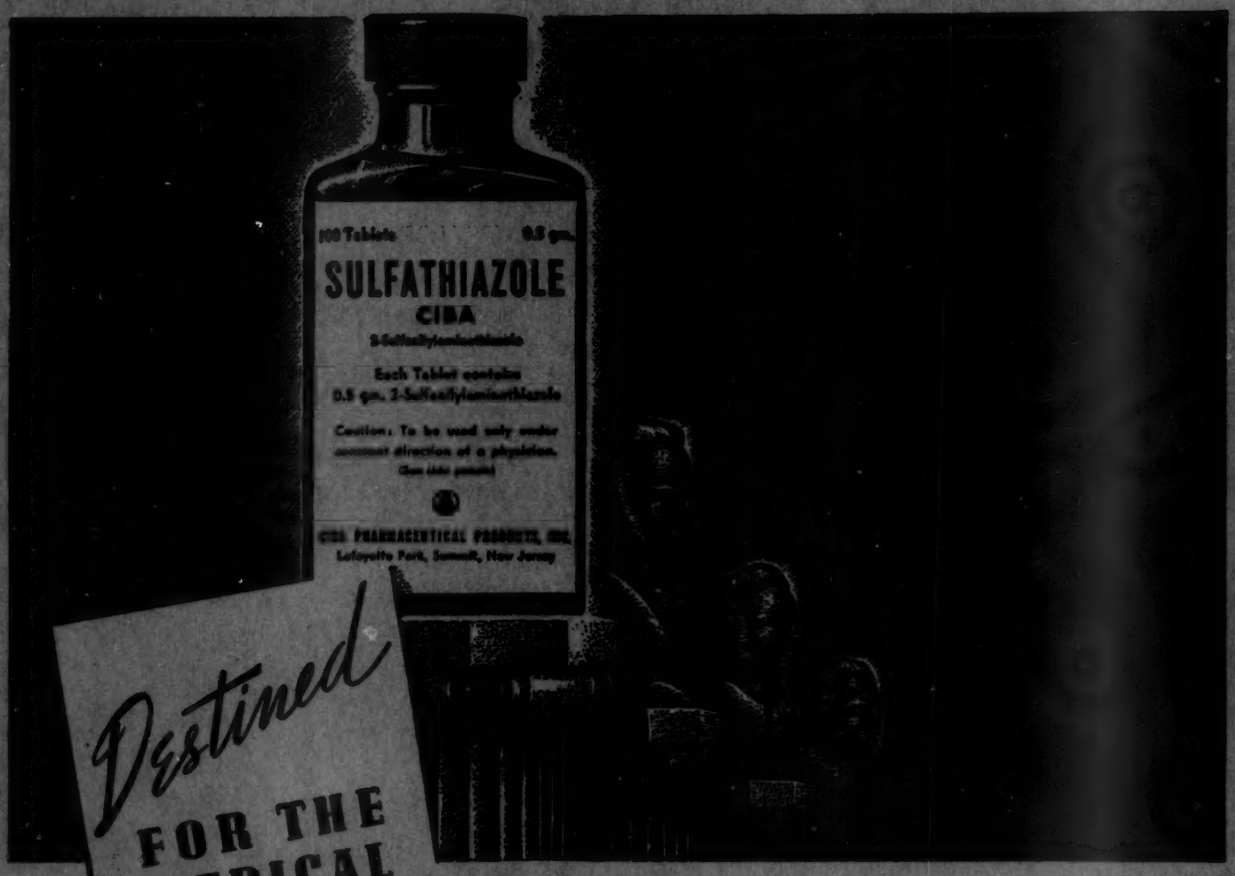

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SULFATHIAZOLE, "Ciba" (2-sulfanilyl-aminothiazole) is available in 0.5 gram tablets, in bottles of 50, 100, 500 and 1000. Also available are 5 gm. bottles of Sulfathiazole crystals for making reagent solutions for estimation of sulfathiazole content of the blood.

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